Creative Computing

THE #1 MAGAZINE OF COMPUTER APPLICATIONS AND SOFTWARE

TENTH ANNIVERSARY!

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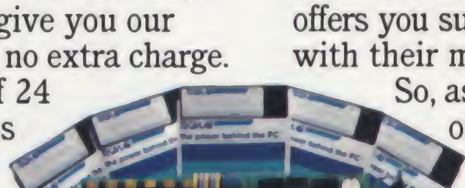

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TENTH ANNIVERSARY!

Creative Computing

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Creative Computing (ISSN 0 097-8140) is published monthly at 3460 Wilshire Blvd., Los Angeles, CA 90010 by Ahl Computing, Inc., a subsidiary of Ziff-Davis Publishing Company. David Ahl, President; Elizabeth B. Staples, Vice President; Selwyn Taubman, Treasurer; Bertram A. Abrams, Secretary. 39 East Hanover Ave., Morris Plains, NJ 07950. Second Class Postage paid at Los Angeles, CA 90052 and additional mailing offices. Editorial offices located at 39 East Hanover Ave., Morris Plains, NJ 07950. Phone (201) 540-0445. Domestic Subscriptions: 12 issues $24.97; 24 issues $43.97; 36 issues $57.97. POSTMASTER: send address changes to Creative Computing, P.O. Box 5214, Boulder, CO 80321. Call 800-631-8112 toll-free (in New Jersey call 201-540-0445) to order a subscription.

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Subscription prices:

U.S.		Canada		Foreign	
1 year	$24.97	1 year	29.97	1 year	34.97
2 years	43.97	2 years	53.97	2 years	63.97
3 years	57.97	3 years	72.97	3 years	87.97

Airmail delivery on foreign subscriptions is available for a one-year period only at $75.00 additional for mail to Asia and Australia, and $50.00 additional for all other foreign.

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STEPHEN B. GRAY

THE EARLY DAYS of Personal Computers

Twenty years ago, while I was the computers editor on *Electronics* magazine at McGraw-Hill, I realized there was much I could learn from building a computer. It didn't take long to find out how difficult it was just to get started. There were no kits, no "cookbooks." Computer textbooks usually contained partial schematics, but none told how to connect the various sections.

After several years of trying to build a digital computer in my spare time, I began to realize how difficult it must be for other hobbyists. So, to solicit information to help me build a machine and to share what little information I had been able to learn on my own, I sent a letter to seven electronics and computer trade magazines and three hobby publications on May 5, 1966:

This is an invitation to those readers who are building their own computers to join the Amateur Computer Society, a nonprofit group open to anyone interested in building and operating a digital computer that will at least perform automatic multiplication and division, or is of a comparable complexity.

The society publishes a bimonthly newsletter containing problems and answers, information about where to get parts and schematics and cheap ICs, and articles on subjects such as Teletype equipment and checking out magnetic cores.

Will interested readers please write to me, giving details on their proposed or in-the-works computers, such as word length, number of instructions, sources of parts and schematics, clever solutions to previous problems, etc.?

Response to the Letter

Five of the magazines printed some or all of the letter, and responses began to arrive. The original idea of the Amateur Computer Society, or ACS, was a membership organization with chapters and a newsletter or two. But the people who wrote in were so widely scattered that local chapters never got beyond the idea stage.

Initially, more than 160 men (but not one woman) wrote from five countries and 27 states, and 110 eventually became early "members" of the ACS, although the most they got was the newsletter—$3 for the 11 issues in the first volume, from August 1966 to December 1968; $3 for the 12 issues of Volume II, from April 1969 to March 1972; and $5 for the 15 issues of Volume III, from June 1972 to June 1976. Only two issues of Volume IV were published: August and December 1976; the ACS Newsletter was then discontinued, with these words:

"Times have changed, and now that kits are so prevalent, there are other publications that serve the readers' purpose better than the ACS Newsletter. Also, the ACS Newsletter always depended heavily upon reader input, and this input has dwindled . . . . Thank you for your support over the last 10½ years. It was fun while it lasted."

ACS membership never totalled more than a few hundred. Nor did I try actively to increase the number, because of the work involved in producing even a few hundred copies of each issue in my spare time. I was doing all the work, including typing, collating, folding, stuffing, and stamping. Had there been enough potential advertisers, the newsletter might have been turned into a magazine, but up until 1974 (and even later) there weren't enough to permit starting up a magazine devoted to computer-building.

Each of the first half dozen issues of the ACS Newsletter was devoted mostly to an individual topic such as sources of schematics, input/output (mainly Teletype), logic circuits, memory, designing a computer kit for the ACS, mounting and interconnections, reference sources (where to find articles and books about computers), etc.

Responses from prospective members ranged all the way from "I've been thinking about building a computer for some time" (two dozen of these) through "I have the shift registers completed" (a dozen of these) to "I've build a computer and am now programming it" (two of these).

Building a Computer in 1966

Back in the mid-sixties, to build a


PERSONAL
COMPUTER
KIT

Nat Wadsworth at his desk in 1981 with a Scelbi-8B, the business version. Behind him, the first ad for a personal computer using a microprocessor was for the Scelbi 8-H in QST magazine.

simple computer accumulator, which could do no more than add successive inputs, using toggle switches for input and lamps for output, cost several dollars per bit. To build an extremely simple "computer" with four-bit words and without memory, and which divided the easy way (by repeated subtraction without shifting), could cost two or three hundred dollars.

Used vacuum tube computers were occasionally available, but such machines brought with them problems of size, power requirements, air-conditioning, and tube replacement costs.

Used transistor computers were seldom available at a price a hobbyist could afford; a Recomp III, even at five percent of its original cost, was still $4750. The cheapest third generation computer was still expensive; a PDP-8/E, made by Digital Equipment Corp., cost $5000 without a Teletype.

Building one's own computer was such a complicated undertaking that very few were ever completed, and nearly all of those were built by electronics engineers working in the data processing industry.

The main problem in building a computer was (and still is) the many technologies involved. Computer companies had specialists in logic, input/output, core memory, mass memory, peripherals, and other areas. To build one's own computer required learning a great deal about each one.

If the computer hobbyist was an electronics engineer working for a computer manufacturer, he could drop in on a friend down the hall or in the next building and ask what kind of drivers might be needed for a core memory with such-and-such specs. Most hobbyists had no such resources.

In addition to having to learn a great deal about computer electronics, the hobbyist also had to get into mechanical areas such as packaging, back-plane wiring, metal working, plastics, and many others.

Memory

Magnetic drum memories were sometimes available, but usually from equipment that had been sledge-hammered before being discarded, and thus were often damaged. Read/write heads only a few thousandths of an inch out of alignment can scratch a drum surface beyond repair.

A variety of core memories was available, but, as one computer memory engineer put it at the time, "The used and surplus memory planes I have seen on the market are real antiques. There are several possible reasons for core planes being in the reject bin. One is that too many cores in the matrix needed to be replaced. Another is that too many were replaced to pass the quality control requirements of a given project." In seeking core memories, the buyer thus had to be extremely knowledgeable.

As for tape drives, one surplus company advertised a Potter model without electronics or even a rack for $150.

The Average ACS Computer

In the seventh issue of the ACS Newsletter, dated November 1967, a survey form was included asking for details of each member's computer, whether in the works or only in the planning stages. The next newsletter gave the survey results.

Most of those who returned the survey form planned on using core memory, the hardest part of the computer to get working; most wanted 4K or 8K words, but few got core up and running.

Teletype was the most common input/output device. Some members also used paper tape, Nixie readout tubes, magnetic tape, and electro-mechanical typewriters.

Clock speeds of the amateur computers averaged 0.5 MHz.

Generally speaking, beginning amateurs hoped to use a large number of instructions, between 50 and 100. Those who had gotten fairly well into the construction used no more than 11 to 34.

The average length of data words and instruction words was 12 bits for each. The speed required for addition ranged from eight microseconds down to ten milliseconds.

The number of registers ranged from two to 11, with three the most popular. One member projected two registers for memory, two for data, one for operation code, and five for address.

As to "cost so far," the range was from zero to $1500, with an average (among those reporting a cost) of $650. For "estimated cost when complete," the range was from $300 to "over $10,000," with an average of $2100.

Education

One of the most significant areas on the survey was education. Most of those responding had at least one technical degree. After noting this high level of education among the membership, the ACS Newsletter commented:

"Because the greatest majority of those sending in the survey have technical degrees, and because those who sent it in are among those who have advanced the most with their computers, it seems that lack of a technical education is holding back many ACS members from pushing ahead with their machines, or perhaps from just getting started. Unlike amateur radio, there just isn't enough circuit level information available on how to build computers."

Several members gave progress reports on the survey form: "Teletype controller and memory operational. Can presently transfer data from Tele-

ACS NEWSLETTER

a publication of the
AMATEUR COMPUTER SOCIETY

Number 7 November 1967

MOUNTING AND
INTERCONNECTIONS
ISSUE

These IBM cards are part of ... ... Allan Sinclair's computer.

CHANGE OF ADDRESS

The new address of the ACS is

Amateur Computer Society
260 Noroton Avenue
Darien, Conn. 06820

Because of this move, and because of a new job (and a new computer to learn), there has been no Newsletter since Number 6 in June.

MOUNTING CIRCUIT BOARDS

Because it's seldom possible to buy used circuit cards with matching card cages, mounting such cards is usually a problem. Especially if they are IBM SMS cards, with the contacts broken off.

Card cages are usually expensive, as are printed-circuit connectors. So, unless you've got a lot of money to spend, you'll probably have to invent a mounting system of your own.

The photo at left above shows how Allan Sinclair mounted a number of SMS cards. The front panel is Bakelite, with 16 long brass eyelets pressed into undersize holes, and with wire soldered to the rear of the eyelets. These eyelets will take an AMP terminal (the eyelets I use will also take IBM patch cords).

The SMS card is held to the panel with a piece of Bakelite, as shown at right. Allan uses General Radio service cement. He says epoxy would no doubt be better, but the cement seems to work, as no strain is involved.

For larger (Univac) cards, Allan bought similar panels, 4" by 8", with 84 jacks already installed, and cut them down. These larger cards are epoxied into either blocks or cylinders of Bakelite, which are then screwed to the front panel. Some of the large

The seventh issue of the ACS Newsletter showed IBM computer cards adapted for use in homebrew computer.

type to register to memory and back. Delay line memory stability problems solved—successfully retrieved data after eight hours." Later, he had to drop the delay line memory, because of poor long term stability. It would work fine for a while, but later would shift by one or two bits, throwing it out of synchronization with the external clock. He tried core memory, then bought a used magnetic drum memory taken from an airborne computer for $100, giving him 8K words.

Innovate or Copy?

Many non-engineer ACS members, unable to design their own computers, tried copying existing designs. Several patterned their instruction set after that of the IBM 1401 or IBM 1620 computer. One Long Island member had software similar to that of the 1620 and hoped that his "IBM 1620 Model III" would be about 25 percent faster than IBM's 1620 Mod II, and would have all of its 60-plus instructions.

Most members who borrowed an instruction set already in use were copying that of the PDP-8 family, manufactured by Digital Equipment Corp. By that time, DEC had sold more than 10,000 of the PDP-8, which was attractive because of its comparatively low price, variety of programs available, and a simple yet powerful set of instructions.

Completed Computers

Only two of those surveyed reported being anywhere near completion of their computers.

Jim Sutherland, an engineer with Westinghouse in Pittsburgh, noted that his Echo IV took a year to build and would need ten years to program. Echo IV was seven feet long, one and a half feet deep, and six feet high. The central processor was complete but, as with all amateur computers, the input/output system was still growing.

Echo IV used 2N404 transistors and NOR logic elements; the NOR gates were originally used in process control systems built by Westinghouse a dozen years before, and had been declared scrap. The gates were mounted on etched circuit boards with 35-pin connectors. A total of 120 boards of 16 types was used in the entire system.

The memory unit, an Ampex 4096-RQ-30A, came from an obsolete process control computer. Memory cycle time was six microseconds, but since the NOR gates required from one to three microseconds to switch, the add time was pushed up to 216 microseconds.

Echo IV had four flip-flop registers, and three registers in core memory. There were 8K words of 15-bit core memory; clock speed was 160 KHz; and there were 18 instructions.

Input was by six alphanumeric control keyboards, eight-channel paper tape reader, 15 interrupts, and 75 relay-contact closures. Output included two printers, 60 relay-contact closures, eight-channel paper tape punch, and four digital clocks. Interconnections were wire wrapped.

The ACS Newsletter

The first volume of the ACS Newsletter (1966-68) provided information about computer trainers, Teletype equipment, circuit boards, ICs, kits, and details of computers built by members. The second volume (1969-72) included information about Nixie readout tubes, core memory, buying reject ICs, memory drums, and the MITS desk calculator kit. It also described the first commercial computer kit, the National Radio Institute NRI 832 (1971). This kit, designed by Lou Frenzel who later moved to Heathkit, had 52 TTL ICs, 17 storage locations, and 15 instructions. The memory consisted of slide switches to simplify the teaching of bit storage.

Volume III (1972-76) looked into Don Tarbell's computer (which multiplied a 140-digit number by itself in 40 seconds), Intel's 4004 and 8008 chips, the Scelbi-8H kit, Radio-Electronics Mark-8 kit, Hal Chamberlain's HAL-4096 computer, and several of the early commercial kits and boards. Only two issues were published of Volume IV in 1976; these dealt exclusively with commercial kits and peripherals as well as several products shown at the first personal computing show in Atlantic City.

A Flattering Accolade

An article by Sol Libes on "The First Ten Years of Amateur Computing" (*Byte*, July 1978, pp. 64-71) was taken largely from items in the ACS Newsletter. Written "to set the record straight," because many people thought personal computing "started only two or three years ago, with the introduction of the Altair 8800 by MITS," it continued:

"If one could find a specific date for the birth of personal computing, it would be May 5, 1966. For it was on that date that Stephen B. Gray founded the Amateur Computer Society and began publishing a quarterly called the ACS Newsletter."

Very flattering, but not true; it was like saying Henry Ford was the father of the automobile. If anything, the ACS Newsletter was the first publication in the world about personal computers. Apparently it is also the only detailed source about the early days; the Smithsonian Institution has asked for a set of the newsletters.

In 1966-67, hoping to get financial backing for full time operation of the Amateur Computer Society and for a projected lower level Amateur Digital Society, I wrote to several foundations and large computer manufacturers, but to no avail. The same thing happened

several years later when I sought financing for several full-time years to write the detailed history of the early days of personal computing.

The following is taken from the only chapter written for that unpublished history, in which the Scelbi-8H was to have been an important milestone.

First Advertised Personal Computer Using a Microprocessor

The first advertisement for a personal computer based on a microprocessor appeared in the March 1974 issue (p. 154) of *QST*, an amateur radio magazine. The ad was for the Scelbi-8H, manufactured by Scelbi Computer Consulting, Inc., of Milford, CT.

Scelbi's founding father, Nat Wadsworth, was a design engineer with General DataComm Industries in Danbury, CT, when Intel gave a seminar nearby on the 8008 microprocessor. But when he and several other young engineers tried to talk management into simplifying products with the 8008, they got nowhere.

Wadsworth, intrigued by the capabilities of the 8008, cornered several other company engineers and asked, "Why don't we design a nice little computer and each build our own to use at home?" Two of them agreed, and Wadsworth and Robert Findley designed most of the system.

"We had planned on building three computers," Wadsworth said later, "because there were three of us in the initial group. But the work on the first prototype was so exhausting that we decided to lay out actual PC boards and have a small quantity made up. Thus, for about the same amount of time involved, we would have a better quality unit. Also, I think the idea of going commercial had always been in the back of my mind."

Incorporating Scelbi

Wadsworth quit his job in the summer of 1973 to work full time on the computer. Scelbi was incorprated in August; the name stood for Scientific, Electronic, and Biological, "because we saw this computer as capable of going into any of those areas." The full name was never used; legally the company was Scelbi Computer Consulting, Inc. "Most people called it

NELSON WINKLESS

THE FIRST HOME COMPUTER

The complete Digi-Comp I system, including (left of Digi-Comp) a Logic Rod, OR crossbar, two AND crossbars, (below Digi-comp) additional register labels; and manuals.

COMPUTERISTS HAVE ALWAYS ENJOYED ARGUING about which machine was the first true home computer. Claims have been made for the Apple, the Altair, Pet, and others, but the original home computer was a machine called Digi-Comp I, introduced in 1963.

The Digi-Comp I featured a 3-bit register, 6 AND gates (which could be reconfigured as OR gates on a two-for-one basis), and operated without electricity via a hand-operated clock. The price was about $5.00 for the basic machine and Instruction Manual, with an Advanced Programming Manual and a book of 50 additional programs available for a few dollars more.

The documentation provided puts many current offerings to shame. The Instruction Manual introduced binary math, programming theory, and the logical concepts of AND and OR in a series of 15 experiments. The Advanced Programming Manual explained how these experiments were developed using Boolean algebra, Venn diagrams, truth tables, logical equations, and flow charts.

The Digi-Comp I was programmed by placing short tubes on various Logic and Clock pegs. Programs available included demonstrations of binary counting and shifting, logical puzzles, and games. Many of these programs were quite impressive.

This little plastic computer was an honorable forerunner of today's technological marvels. It gave many people their first understanding of digital computers and programming, at a time when personal computers were found only in science fiction. ■

Skell-bee, but we pronounced it Sell-bee."

Wadsworth worked up to 18 hours a day turning the prototype board into commercial PC boards, and private investors started lining up. But several months later, in November 1973, at the age of 30, Wadsworth had a heart attack. This stopped everything for a while, and the investors disappeared. But Wadsworth recovered, finished the design, and the company started advertising. "We chose *QST* because we knew that many hams were dyed-in-the-wool electronic enthusiasts." All that came with the computer were the assembly instructions; the user was expected to know—or learn—something about programming.

"Why don't we design a nice little computer and each build our own to use at home?"

Response to the ad was large, so Findley joined the company, others were hired, and then in May 1974 Wadsworth had a second heart attack. This "pretty well removed Scelbi from having a chance at making it big in those days, and it never became a major factor. But we continued to limp along. It became—for me, anyway—a different thing. I started doing it more for love, for the joy of still being alive, than for any ideal of a commercial enterprise."

While in the hospital, Wadsworth started writing a book, *Machine Language Programming for the 8008*. "We published it ourselves, on an offset press, as it came off a Teletype. It was absolutely horrendous esthetically, but to our utter amazement, when we casually advertised it, it sold something like 1500 copies within a month or two at $20 apiece.

"Soon we were taking in more from the manual than we were on computers! I figured out that if Scelbi was to keep going, it wasn't to be as a computer manufacturer. We stopped advertising the computer to concentrate on books and software.

"Altogether we sold about 200 computers—half assembled, half kits." Half were Scelbi-8H hobby computers with up to 4K of memory; the rest, differing mainly because of more memory (up to 16K), were Scelbi-8B business computers. The Scelbi-8H first went on sale March 1974, the 8B in April 1975.

"For that time, we had a very sophisticated system, a complete system. We had a tape cassette interface that actually worked a lot better than the ones MITS started selling. We had a CRT based on an oscilloscope, and Teletype interface, and we developed a combination monitor, editor, and assembler in ROM."

Scelbi began to "develop software products to support the 8H and the 8B, but which were put in book form: our editors, monitors, and assembler. We sold thousands of copies. After the success of those books, we went on to modify them for the 8080, for the Altair, the Imsai, whatever was out at that time."

Cookbooks

"During this evolutionary period, we got the idea for the cookbooks. The first two were written by Bob Findley. The first was for the 8080, patterned after my machine language programming book. What we had was an engineer's handbook that presented the instruction set and utility routines. We had a full floating point package in there, which I had developed for the 8008. That was an extremely successful book. Tens of thousands of the cookbooks have been sold in virtually every edition we put out. It became a classic.

"We lost money the first several years of operation at an average of $500 per computer. We did not start making money in this company until we were in publishing, and then we made up for the losses. Otherwise we wouldn't have been able to stay in business."

The Scelbi Influence

Asked what he thought was his influence on personal computers, Wadsworth replied in 1981, "Well, I think I had a lot of influence I never knew about. I know lots of instances of companies that were started by individuals who were initially dealing with me. For example, one of our first systems was sold to a fellow from the Midwest. We then had conversations with them which we later determined were nothing more than snooping on our marketing and everything. And they started a company producing microcomputers.

"One thing I've always found amusing is that when MITS began advertising, they claimed they had the first computer for personal use. And then in their newsletter they offered to trade our computers for theirs."

Wadsworth sold the rights to publish Scelbi books to other publishers to concentrate on a newsletter for pocket computers.

Did he get any recognition for being one of the pioneers? "Not really. It has always escaped people's attention. Certainly MITS wasn't going to say, 'Well, really, Scelbi was up there.' Jonathan Titus and those boys, they say, had the first mass produced computer, the Mark-8, which was not really a commercial product. It was a hobby thing.

"I don't think people really know today that we were the first commercial producer of computers."

"I don't think people really know today that we were the first commercial producer of computers. And I don't stay up nights worrying about that, because I never cared about being first. It was what I was interested in doing, and we went ahead and did it, and we would have done it a lot more successfully had I not had the health problem. It could have been a whole different story."

The MITS Altair

The $179 MITS desktop calculator kit was soon overwhelmed by fully assembled Japanese calculators that were cheaper than the kit. To stay alive, MITS brought out a computer kit for which there was no time for the further development it could have benefitted from. Although the Altair was not easy to assemble or use, MITS knew how to market it with four-color ads in professional and hobby magazines.

However, that's another story, to be found elsewhere in these pages. ■

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FORREST M. MIMS III

THE ALTAIR STORY

Early Days at MITS

As one of the co-founders of MITS, Inc., the company whose Altair 8800 pioneered the personal computer industry, I have been both amused and concerned by the proliferation of articles and books containing inaccurate accounts of the early days at MITS. Since MITS has now earned an important place in microcomputer history, I hope this account will lay to rest at least some of the myths and misconceptions that have appeared in print over the past decade.

For this article I have relied upon personal records and my collection of early MITS documents, correspondence, manuals, products, and memorabilia. Furthermore, I have discussed by telephone most of the key points of the story with many of the people involved. I very much enjoyed putting this account together and hope it proves both useful and interesting.

Ed Roberts

Though MITS was officially founded by four partners, H. Edward Roberts was the company's driving force and its real founder. I first met Ed in the summer of 1968 when he was assigned to the Effects Branch of the Air Force Weapons Laboratory at Kirtland Air Force Base in Albuquerque, NM.

Though Ed was a brand-new second lieutenant when he arrived at the lab, he wasn't new to the Air Force. He had been an enlisted man for several years and had been commissioned after the Air Force sent him to Oklahoma State University where he received a degree in electrical engineering.

I remember well one of Ed's first assignments, to purchase for our branch Hewlett-Packard's new, state-of-the-art 9100 desktop computer. Ed was attracted to that machine like a magnet. Within a few days of its arrival he devised a program for calculating the parameters of transistor amplifiers. Even today, Ed recalls clearly the impact the desktop 9100 made on him.

As for computers, both Ed and I had prior experience as do-it-yourself computer hobbyists in the early 1960's. While a high school student, I had built a series of analog computers. My most advanced machine, which included a programmable analog memory array, could translate 20 words of Russian into English. Ed, too, had built analog computers. He had also built digital machines that used relay logic.

Reliance Engineering

Ed's Air Force career had not kept him from dabbling in free enterprise. While stationed at Lackland Air Force Base in San Antonio, TX, for example, he was the sole proprietor of *two* one-man companies, Reliance Engineering and Reliable Radio and TV. One of Reliance Engineering's biggest jobs was the assembly of the electronics that controlled the movements of the animated Christmas characters in the windows of the Joske's store across from the Alamo.

From the time I first met him, Ed often talked of placing Reliance Engineering back in operation. He was utterly confident his entrepreneurial gifts would allow him to fulfill his ambitions of earning a million dollars, learning to fly, owning his own airplane, living on a farm, and completing medical school.

Once he teamed with Glen Doughty, a captain in our branch, to design and build an infrared instrusion alarm for his uncle's fish farm in Florida. A few months later, he and Stan Cagle, a civilian electrical engineer whom Ed had known when they were

both college students, worked together to design and build a regulated power supply they intended to sell. That project, which was never completed, soon led to the formation of MITS.

MITS

By 1969 the Effects Branch of the Weapons Lab had become part of the Lab's well-funded, highly classified Laser Division.Though I was working with state-of-the-art laser technology and super secret projects, I still found off-duty time to pursue my favorite hobby, model rocketry.

Several times I had mentioned to Ed the high level of interest among model rocketry enthusiasts for miniature light flashers for night launched rockets and economical telemetry transmitters. In the summer of 1969, we decided to meet with Stan and discuss the possibility of forming a company to design and sell telemetry gear for model rockets.

This first meeting took place in the kitchen of Ed's home in northeast Albuquerque. Besides Stan, Ed, and myself, Bob Zaller, another officer from the Weapons Lab, was present.

We spent most of the meeting discussing a proposed line of telemetry products. In retrospect, however, our most important action that night was to elect Ed president of our infant venture.

Our second meeting, like most others over the course of the next 18 months, was held in a spare front bedroom in Ed's home. A principle item on the agenda was what to call our company. Ed preferred Reliance Engineering, but I objected. Because the Massachusetts Institute of Technology was the center of model rocketry research, I suggested we form an acronym around the letters MIT. Perhaps, I suggested, we could call the company MIT Systems.

Stan and I then tossed out ideas for the acronym. I suggested micro for the M and telemetry for the T. Within a minute or so, Stan responded with Micro Instrumentation and Telemetry Systems.

Though I liked the MIT connection, Ed was unsure about the name. Wouldn't we be referred to as mits? I insisted people would refer to us as M-I-T-S, just as MIT is referred to as M-I-T.

Ed's second point was more valid. Reliance Engineering, he argued, was an existing company with an established credit rating. I offered a compromise: Why not designate MITS as a subsidiary of Ed's original company? This approach was acceptable to everyone.

Incidentally, my premise about the enunciation of our company name proved wishful thinking. Later, we even capitalized upon the name by labeling as MITS KITS some kits we sold.

Years later, Ed joked with me about the "hundreds" of times he had to explain how MITS got its name. In retrospect, he probably should have renamed the company after he introduced the Altair 8800, but that's getting ahead of the story.

Tooling Up

Though MITS's affair with model rocketry was to last but one year, it set the stage for the chain of events that led eventually to the Altair. Therefore the story is worth telling.

As resident model rocket fanatic and MITS marketing director, one of my responsibilities was to specify the various modules for our product line. My first magazine article, "A Transistorized Tracking Light for Night Launched Model Rockets," had been published in the September 1969 issue of *Model Rocketry* magazine, and I recommended the flasher as one of our first products.

In their capacity as MITS design engineers, Ed and Bob refined my design in Ed's garage workshop while Stan, our production engineer, laid out and made the etched circuit boards in his apartment. The TLF-1 light flasher soon followed.

Within a month, Ed, Stan, and Bob had completed work on two transmitters plus a variety of modules. In the meantime, I was hard at work writing "The Booklet of Model Rocketry Telemetry."

By October the circuit designs for the product line were finalized, and I wrote a press release and mailed it to *Model Rocketry*. It was published in the December 1969 issue.

While waiting for the release to appear, Ed, Stan, and Bob assembled hundreds of modules while I wrote operating instructions, designed an order form, and mimeographed big stacks of our self-published booklet. I also launched a series of rockets equipped with MITS transmitters and modules, all the time hoping for a photogenic crash that would demolish a rocket payload section while leaving the instrumentation unharmed.

In late 1969 we decided to incorporate. Each of us was given 950 shares of stock with the remaining 200 shares going to our attorney.

Each of us also made a contribution of cash and equipment to MITS. My $100 check was dated January 16, 1970. Ed had insisted that none of us become "silent partners," and, beside providing needed capital, the cash donations gave each of us a vested interest in the future of MITS.

In March 1970 the first MITS advertisement appeared in *Model Rocketry*.

The April issue of *Model Rocketry* included a second MITS news release. Also included was an attractive photograph showing one of our transmitters surrounded by six modules.

In spite of our countless hours of work, by May we had sold only a hundred or so transmitters and modules. As marketing director, I suggested we might increase sales greatly by cutting prices. How? By converting our line of preassembled modules into *kits*.

We decided to test this new approach by converting the TLF-1 light flasher into two kits, one with a dual flash rate and the other with an adjustable flash rate. The first ad for these MITS KITS appeared in the July 1970 *Model Rocketry*.

Popular Electronics Magazine

Big changes took place at MITS in the summer of 1970. As early as May we had recognized that our fortunes would never be made by selling model rocketry telemetry instruments to precocious teenagers and university professors. About this time, Bob Zalle, who was soon to be married, decided to leave MITS. (He later returned after the Altair was introduced.)

I also made a big change. In late 1969 I had decided to leave the Air Force upon completion of four years of service to become a freelance writer while continuing to work with MITS. I left the service on June 11, 1970 and immediately began work as the night attendant at the parking lot of Albuquerque's airport, the Sunport.

I took this night job thinking it would provide plenty of time for writing, and it did. The salary, however, was only a fourth what I had earned as an Air Force captain. Worse, I had to live with the pitiful looks on the faces of my former commanders and co-

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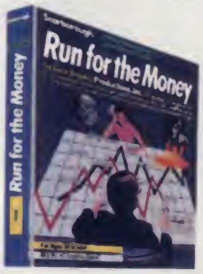

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workers each time they drove out of the parking lot after returning from their frequent trips. They thought I was crazy to trade a position in state-of-the-art laser research and development for the parking lot.

In March, I sold my first article to *Popular Electronics* magazine, a feature about light emitting diodes. At one of our midnight meetings I suggested that we emulate Southwest Technical Products and develop a project article for *Popular Electronics*. The article would give us free advertising for the kit version of the project, and the magazine would even pay us for the privilege of printing it!

Ed had received a big bag of integrated operational amplifiers and comparators from a friend, so several times we seriously discussed using these chips to develop a kit analog computer. Since junior high school days I had been an abacus user, so we also discussed the possibility of making a solid state abacus, using red LEDs for the beads. Finally, I suggested we design an infrared voice communicator.

We decided upon the infrared communicator, so I contacted the magazine, and they agreed to consider the article. They also decided to hold my feature about LEDs and published the two articles as a pair. That summer, while we continued to fill model rocketry orders, Ed began designing what I called the Opticom.

In late July, before the Opticom was ready, I received a call from Leslie Solomon, technical editor of *Popular Electronics*. Les was coming to Albuquerque with his wife and daughter. Could he stop by for a visit?

I was elated. By then I was writing a monthly column for *Model Rocketry*, but this would be a chance to meet an editor from a magazine with considerably more clout. Furthermore, this would provide the opportunity to introduce Les to Ed and Stan and discuss our kit ideas.

The Solomon family arrived at my mobile home on Monday, August 3, 1970. Les and I retired to my tiny electronics workshop while our wives spent the afternoon visiting. That evening, we met Ed and Joan for dinner at the Beef and Bourbon, a steakhouse on North San Mateo Street several blocks from Ed's house. Stan had to work that evening and couldn't join us.

A summer thunderstorm brought welcome relief from the afternoon heat. While it thundered outside, Les poked

JAY ALAN RICHARDSON

ZAP, CRACKLE, POP

At the first (and only) World Altair Computer Convention, Barbara Solomon of the Daylight Computer Company kept track of visitors to the booth on-line, while Harry Garland (rear) showed off his TV Dazzler; March 1976.

THE FIRST PERSONAL COMPUTER SHOW, the World Altair Computer Conference, in March of 1976 leaves many astonishing images burned in the memory. Bill Gates delivering his first impassioned anti-piracy speech, Ted Nelson shaking his fist and leading chants of "Computer Power to the People," and Harry Garland reloading. What?

Harry Garland and Roger Melen jumped into microcomputers with the company Cromemco as soon as MITS broke ground with what became the S-100 bus. When the WACC was announced, they whipped their products into shape (some nice graphics stuff, the game of Life, and a fascinating camera) and hied them to Albuquerque with their own computer.

The computer had been designed by people in Palo Alto on the somewhat humid shores of San Francisco Bay. Harry found himself standing next to his computer in the desert dry Marina Hotel in Albuquerque.

Every time somebody took two paces across the carpet in that dry environment, he built up a dramatic static charge. When the walker's hand reached toward Harry's computer, a blue flame would leap from the walker's fingertips into the computer, and obliterate all of the knowledge in its PROMs. Harry would blanch, mutter, and reload the system painfully and slowly in those pre-floppy days, sighing for the soothing saltwater of Yerba Buena.

He was an inspiration to us all: game, grim, patient, and gracious as he reloaded those rotten PROMs hundreds of times during the three days of the WACC.

And you thought Stanford professors were soft? Hah! Harry needed and displayed the grit to persist in this hilarious business while men of less stern stuff quailed and failed. Cromemco flourishes still. Zap, crackle, pop, Harry. Cheers. ■

fun at the restaurant's decor while Ed and I silently wondered how we would ever manage to pay the bill. After the meal, our wives visited and the children fidgeted while Les, Ed, and I spent a couple of hours discussing MITS and our proposed Opticom project. Les seemed enthusiastic about the project and encouraged us to get it completed as soon as possible.

We discussed other matters as well. Like how many kits could we expect to sell. (Who knows? Maybe a few hundred, maybe a thousand.) We also talked about writing as a profession. Detecting my optimism about becoming a full time freelancer, Les volunteered that it was next to impossible to make a living from writing outside New York.

Les Solomon's visit provided all the motivation we needed to finalize the Opticom. When the first transmitter and receiver pair were completed, I field tested the units and wrote the construction article. Since the design was Ed's, I bylined the article with both our names. *Popular Electronics* soon paid for the piece with a check for $400 which I deposited in the meager MITS checking account.

In the meantime, Ed arranged to finance the Opticom kits by borrowing a few thousand dollars from an Air Force friend. We also decided to move our Opticom kit production line into a building.

Since I worked nights, I was assigned the daylight task of renting a building. I began looking on September 30 and by October 9 narrowed the search to a former snack bar called The Enchanted Sandwich Shop. I rented the small brick building for about $100 a month.

My LED feature and the Opticom article were featured on the cover of the November 1970 issue of *Popular Electronics*. When the magazine appeared in late October, we began receiving as many as a dozen orders a day. But within a few weeks, the surge slowed to a trickle. We eventually shipped a little over a hundred Opticoms—far fewer than we had hoped.

The Split

Shortly before the Opticom article appeared, Ed and Stan had begun work on a desktop digital calculator. As Stan recalls it, Ed was so intrigued over the prospect of building a calculator he was willing to use TTL logic chips. Fortunately, Stan happened to see in *Electronics* magazine an ad for a calculator chip set manufactured by Electronic Arrays, Inc.

Ed wanted to move directly from the Opticom to a calculator kit before bigger companies became involved, but Stan and I held back. Stan wanted to use up our remaining Opticom parts and lenses by continuing our plan to develop an infrared intrusion alarm kit, which was nearly ready, and a solid state laser. Remembering the competition we faced soon after introducing the telemetry line, I felt the calculator venture was very risky.

The difference in opinion over which path to take led directly to a permanent split. One night in early November, Stan visited the parking lot and suggested he and I offer to buy Ed's stock. But on my salary, I could barely put food on the table.

Though we disagreed with Ed's timing of the calculator idea, Stan and I realized Ed would go ahead with the calculator project with or without us. As things developed, Ed offered to buy our stock.

Stan, Ed, and I held our final meeting as MITS partners on November 10, 1970 in the parking attendant's booth at the Sunport. With help from his Air Force friend, Ed offered to buy our stock for $300 cash, $300 by the following March, and $350 in equipment. I took my equipment in the form of unsold model rocket telemetry gear.

Stan and I had both agonized over our decision to leave MITS. Even though we had never paid ourselves a salary or a bonus (there simply wasn't the money to do so), for me the decision to leave MITS was harder than resigning from the Air Force.

On the other hand, the excitement of seeing my first two articles featured as cover stories in *Popular Electronics* was still fresh in my mind. Leaving MITS would provide much more time to develop my budding writing career.

MITS Enters the Calculator Business

Ed's uncanny ability to recruit engineers, technicians and financial backers has always served him well. By the time Stan and I signed the papers transferring our stock to Ed, he had teamed up with Bill Yates, a young second lieutenant from the Laser Division at the Weapons Lab. He also secured additional financial help from another officer.

Ed moved the MITS assembly line from The Enchanted Sandwich Shop back to his garage for the next several months. He then moved MITS to a rented house at 2016 San Mateo, N.E. In the meantime, he had acquired a chip set from Electronic arrays and began work in earnest on the calculator project. The first crude prototype, however, failed to work. The expensive chips had been installed in their sockets backwards!

In August 1971 I left the parking lot to become a full time freelancer. I had just sold a pair of articles about semiconductor lasers to *Popular Electronics*, one of which described a solid state laser transmitter and receiver.

The laser project had been on the agenda before Stan and I left MITS, and Ed agreed to sell a kit to use up unused Opticom parts and lenses. In return for a royalty from MITS, I agreed to write assembly manuals for the transmitter and receiver plus a manual of kit assembly hints. Consequently, I spent a good deal of time at MITS during the final stages of the development of the 816.

Since we had both built Heathkits, I told Ed the laser manuals would meet Heath's standards. He must have liked them, for after the manuals were completed Ed asked me to write the assembly manual for the calculator project. In return, he would give me a calculator.

To borrow a phrase from Ed's lexicon, the calculator project *wasn't* trivial. Indeed, it is fair to say that in many ways it was more complex than the Altair.

In the last few days before the 816 calculator appeared on the cover of *Popular Electronics*, the MITS operation at 2016 San Mateo was a beehive of activity. I spent two very busy weeks writing the 64-page assembly manual. The laser project had been published in the October 1971 *Popular Electronics*, but the hundred or so orders that came in caused only a small ripple in the onrushing press to complete the calculator.

Ed's article about the MITS 816 calculator was featured on the cover of the November 1971 issue of *Popular Electronics*. An accompanying editor's note described the 816 as "an exciting new breakthrough construction project —a modern, high-speed 16-digit calculator."

MITS offered a kit version of the

816 for $179 and an assembled machine for $275. Subsections of the machine and the circuit boards could also be purchased. For only $2, ambitious do-it-yourselfers could purchase complete mechanicals, circuits diagrams, and foil patterns.

The 816 calculator was a major success, and, for the first time, MITS earned a profit. Moreover, the 816 article marked an important turning point in hobby electronics, for it was a portent of the eventual arrival of low cost personal computing.

Consider this: Even before the 816 design was completed, Ed had designed a 32-step programming unit that would transform the machine into a *programmable* calculator. Complete interfacing terminals for the programmer, which was scheduled for introduction in April 1972, were included on the original 816 CPU circuit board.

Besides being too small for the burgeoning company, the house MITS occupied on San Mateo was scheduled for demolition so the street could be widened. Therefore, in 1972 Ed moved MITS to a larger building at 5404 Coal Avenue S.E. Eventually, MITS settled into a series of adjacent storefronts at 6328 Linn Avenue S.E., just a few blocks from my mobile home. There a wave soldering machine and an efficient assembly line were set up.

At the Linn Avenue operation Ed added a technical writing staff and even a receptionist. Though I wasn't needed for manual production, he and I collaborated on a series of magazine articles about digital logic and one of the first published calculator books.

MITS eventually introduced a line of compact calculators with LED displays. While MITS was selling many thousands of calculators, the big companies began their move into the field. Eventually, MITS was forced out of the market, and by 1974 the company was some $200,000 in debt. Discouraged but not down, Ed decided to leapfrog the calculator industry by developing an even more powerful product.

The Altair 8800

The defunct MITS calculator line had evolved from a mail order magazine project for electronics hobbyists into a bonafide consumer business. For his new product, Ed was to return to the marketing strategy that had served MITS best.

The new product was his most ambitious yet, an affordable microcomputer designed around Intel's new 8080 8-bit microprocessor. The project would fulfill Ed's lifelong ambition to design a working digital computer. And, if successful, it would save his company from bankruptcy.

Though he was fully prepared to sell the computer he planned by means of ads in electronics magazines, the method he had used to sell calculators, the *Popular Electronics* connection intervened. It so happened that Arthur Salsberg, the magazine's editorial driector, had been actively searching for a computer project since early 1974.

Art's interest had been stimulated by an ASCII keyboard and encoder project designed by Don Lancaster of TV typewriter fame. Don's project, which was available as a kit from Southwest Technical Products, was the cover story of the April 1974 issue of *Popular Electronics*.

Art discussed the possibility of a computer project with Les Solomon. They eventually located a microcomputer trainer project by Jerry Ogdin. Art scheduled the trainer for the December 1974 issue of *Popular Electronics*.

In those days there was a healthy rivalry between Art's magazine and *Radio-Electronics*. As Art recently wrote in a letter recalling that early period, Jonathan Titus's Mark-8 8008-based computer in the July 1974 issue of *Radio-Electronics* caused Ogdin's microcomputer trainer project to be placed on hold. "I felt as if the rug was pulled out from under me," Art wrote. He very much wanted to "top their article."

Art asked Les if he knew of a more advanced computer project, particularly one using Intel's new 8080 microprocessor. Les was aware of Ed's project, so Art asked him to call MITS to see if Ed could deliver an article in time for a winter issue. "Tell him that he's got to have an attractive cabinet in order for it to be a cover story," Art recalls telling Les.

Soon Les raced into Art's office to tell him Ed could deliver a computer project in time for the January issue. "January is always the best-selling newsstand issue we've got," Art observed.

A few weeks later Ed called Art to inform him the computer would be housed in an attractive, multi-colored Optima cabinet with a shadow box design. Art postponed Ogdin's project, slating it for use as a backup in the event MITS didn't come through.

In the meantime, Ed, Bill Yates and a few others left over from the post-calculator bust were hard at work preparing the prototype computer. Ed designed the interface logic for the 8080, a 256-byte RAM memory, a 2MHz clock, and the front panel logic for the 25 control/input switches and 36 indicator LEDs on the machine. Bill Yates laid out the foil patterns for the circuit boards.

Ed also made what was to prove a momentous decision: He included provisions for an open bus so additional memory and peripheral cards could be added later. The oversize Optima cabinet could accomodate up to 16 additional cards. Therefore, Ed designed a hefty 8-ampere power supply for the machine, having no idea that even this much power would later prove inadequate for the dedicated computer fanatics who stuffed their blue and gray cabinets with peripheral cards.

Ed shipped the completed prototype via REA to *Popular Electronics* and then flew to New York to demonstrate it for the editorial staff. Alas, the machine never arrived. It was apparently lost or stolen at Kennedy Airport.

Nevertheless, Ed spread out the circuit diagrams and explained the operation of the machine. He then accompanied some of the editorial staff to dinner at an Italian restaurant before leaving for Albuquerque.

Ed recently recalled how troubled he was during the flight home. He had managed to borrow an additional $65,000 to float the computer project, but in spite of the magazine's assurances he had no firm agreement they would publish the project. "What really bothered me," he later told me, "was that Les Solomon said 'I think we're casting our pearls before swine on this one.'"

Art needed a computer right away for front cover photography, so Bill Yates put together a non-functional mock-up and shipped it to New York. Later, they also built a second prototype and shipped it to the magazine.

Then, there was the matter of giving the machine a name. David Bunnell, vice president of marketing and advertising manager for MITS, the jobs I once held, came up with three pages of suggested names. Among his favorites was Little Brother.

Ed eventually called the computer the PE-8, but Les Solomon felt that was a rather dull name for such a powerful and momentous product. Les discussed the matter with associate editor Alexander Burawa and assistant technical editor John McVeigh. Al later remembered saying, "It's a stellar event, so let's name it after a star." Within a few minutes, John McVeigh said "Altair."

Les called Ed to try out the new name, but Ed's concerns were elsewhere. He told Les he didn't care what they called the computer so long as MITS could break even by selling 200 of them.

The Altair was featured on the front cover of the January 1975 issue of *Popular Electronics* as a "Project Breakthrough! World's First Minicomputer Kit to Rival Commercial Models." The magazine appeared on newsstands a week before Christmas of 1974.

In the accompanying article by Ed Roberts and Bill Yates, MITS offered a complete kit version of the machine for an incredible $397. A fully assembled version was available for $498.

Art Salsberg titled his editorial "The Home Computer is Here!" He wrote, "we were determined *not* to present a digital computer demonstrator with blinking LEDs that would simply be fun to build and watch, but suffer from limited usefulness...What we wanted for our readers was a state-of-the-art minicomputer whose capabilities would match those of currently available units at a mere fraction of the cost."

Art ended this momentous editorial by promising "There'll be more coverage on the subject in future issues. Meanwhile, the home computer age is here—finally."

Well, maybe. While tens of thousands of readers eagerly read every letter and comma in the Altair article, Art was questioned about the wisdom of the piece by one of his superiors. How could he justify the Altair project when no computer companies advertised in the magazine? This concern was not neutralized when MITS bought a full page ad in the February issue. The ad ran across from the second installment of the Altair article.

Meanwhile, back in Albuquerque, orders came flooding in. The response was overwhelming. Already backlogged with orders, Ed didn't even have an operator's manual for the Altair. He called in early January and said, "I'm going to make you an offer you can't refuse."

I bicycled over to Ed's office where he offered me an assembled Altair in return for a quick job on the operator's manual. He was right, it was an offer I couldn't refuse.

The World Altair Computer Convention (WACC)

The flood of Altair orders soon had Ed hiring more people and looking for bigger quarters. MITS organized an Altair user's group, and in April 1975 several MITS marketing people drove the MITS mobile, a motorhome equipped with Altair equipment, on a tour through Texas. The MITS mobile team was eventually to visit many cities across the country, giving seminars, staging slide shows, and distributing literature, catalogs, and door prizes.

By June 1975, David Bunnell was editing a monthly tabloid called *Computer Notes, a Publication of the Altair Users Group*. In the November/December issue of *Computer Notes*, Bunnell announced in a banner headline ALTAIR CONVENTION.

The meeting, which was Bunnell's brainchild, was officially called the MITS 1st World Altair Computer Convention. It was scheduled for March 26-28, 1976 to coincide with the completion of the move to the new MITS headquarters in a brand new building adjacent to the Albuquerque Sunport.

The WACC deserves credit as the first major microcomputer convention. But the WACC was responsible for an even more momentous development, the formal arrival of competition. The lobby of the Airport Marina hotel where the WACC was headquartered buzzed with rumors about some people from Processor Technology who had rented an upstairs suite.

I made my way through the crowd and peered over the heads of the curious onlookers and saw the future: memory boards priced cheaper than those sold by MITS. The Altair's open bus had paved the way for the arrival of a microcomputer *industry*.

The Legacy of the Altair

An era ended in 1977 when MITS was sold to Pertec Computer Corporation. Ed stayed with MITS for a while, but eventually moved to a 900-acre farm in Georgia. He is now in his third year of medical school at Mercer University. He also heads a new company called Georgia Medical Electronics.

Today, comparatively few users of personal computers have ever heard of MITS and the Altair 8800, much less Ed Roberts. This is unfortunate, for Ed did for computing what George Eastman did for photography.

No, Ed did not *invent* the microcomputer. That credit belongs to the brilliant engineers who designed the early microprocessor and calculator chips.

Nor was the Altair a perfect machine. Ed himself admits the infamous 4K memory board was a major mistake. MITS made other mistakes as well, some of which it candidly admitted in *Computer Notes* (which was subsequently acquired by *Creative Computing*).

As for those who criticized the limited capacity of the 8-ampere power supply, how was Ed to know an industry would spring up almost overnight with the sole purpose of supplying peripheral boards for his Altair? Some of these boards, like the Godbout Electronics 4K static RAM, consumed nearly two amperes!

Sure, there were problems, but consider what MITS accomplished! The first computer stores *anywhere* were set up to sell Altairs. The open Altair bus paved the way for a microcomputer revolution. And everyone who uses Microsoft Basic can thank Ed Roberts for the decision to select the version of Basic developed by Paul Allen and Bill Gates for the Altair over the other languages he considered.

In the final analysis, MITS pioneered nearly every aspect of today's microcomputer industry. Computer shows, users' groups, newsletters, seminars, software exchanges, peripherals, software products, quality documentation, and cheap computers, all commonplace today, were first pioneered for the personal computer market by MITS.

Recently Ed and I lamented the fact so many of today's computer users think Apple, Radio Shack, or even IBM invented personal computing. We also wondered about the distorted versions of the early days at MITS written by some of today's computer journalists.

I'll have much more to say about the early days at MITS and the Altair in a forthcoming book. In the meantime, I hope this preliminary account has helped set the record straight. ■

COMMODORE MAKES SOFTWARE FOR EVERY MEMBER OF THE FAMILY.

Commodore makes software for uncles, cousins, aunts who teach, nieces, nephews, brothers, sisters preparing for exams, fathers, mothers and brothers-in-law in roofing and tiling.

You see, Commodore makes software for fun, profit, homework, housework and office work.

Our Easy-Calc (upper left) is an electronic spreadsheet that's 63 columns x 254 rows with graphics and bar charting. And even with color options.

Fish Metic™ (upper right) is an educational math program in a game format. With our Manager program (lower left), you get a sophisticated

ALMOST.

database system with four built-in filing applications. Or you can design your own.

Why, in the lower right hand corner, there's even a . . . oh, we don't make that one yet.

But we're working on it.

Incidentally, we also make the perfect place to use all these software programs (except the last one): the all purpose Commodore 64,™ the world's best selling computer.

COMMODORE 64

IT'S NOT HOW LITTLE IT COSTS, IT'S HOW MUCH YOU GET.

DAVID H. AHL

The First Decade of Pers

Question: What is: an Altair, a Sphere, a Jolt, an RGS, a Scelbi, an SWTPC, a Micro 440, a Mike 2?

Answer: They are all microcomputers available at the end of 1975.

Most of the companies who made these systems are not around today (SWTPC, Southwest Technical Products, is an exception); indeed, many lasted only two or three years. Right from the beginning, commercial success in the personal computing field has been elusive. Why is this, and how did personal computers get to where they are today? To answer these questions, we will have to run the clock back to the late 50's.

Up until the late 50's, most computers were room-filling monsters which required a small army of people to operate and maintain. Only eight companies were actually making general purpose computers: IBM, Univac, Honeywell, Burroughs, General Electric, RCA, NCR, and Control Data. IBM had already achieved a position of dominance, so this group was known as Snow White (IBM) and the seven dwarfs.

One-on-One Computers

However, in the late 50's several newcomers entered the field with smaller, cheaper machines known as minicomputers. The two leaders in this field were Digital Equipment Corp. (DEC) and Hewlett Packard (HP). For the first time, there were computers that could be operated by a single person. In a sense, these were the first personal computers although their price ($30,000 and up) put them out of reach of home users.

For the most part, makers of mainframes were selling single machines to end users and providing a great deal of handholding after-sale support. Minicomputer makers, on the other hand, were selling mostly in quantity to OEMs and value added resellers and providing very little after-sale support. The only exceptions were small groups at DEC and HP that sold systems to end users such as colleges and laboratories. Even so, the support provided was relatively minimal. Thus, although plans to sell computers to in-

onal Computing

dividuals were occasionally proposed to various mini makers, such plans generally fell on deaf ears at the corporate level.

Thus, the personal computing revolution was destined to come from outside the established corporate environment. The seeds of this revolution were scattered all over the country. Although today we may think of the personal computer industry as being centered in Silicon Valley, in 1975 the active players were located in Bountiful, UT; Huntsville, AL; San Antonio, TX; Albuquerque, NM; Northbrook, IL; Milford, CT; and Santa Clara and Los Altos, CA.

What did it require to be an active player in the early 70's? Not much, as it turns out. A good knowledge of circuit design, enough money to build a working prototype and buy a few ads in *Byte*, and a partially empty garage. The typical company founder in those days was an engineer (usually self-taught, but occasionally with formal training). Some of the early designs were clean and efficient, but more often the designs were considerably short of perfection and had jumper cables and "fixes" all over the boards.

In many cases, the actual production of a computer or peripheral was financed by the orders of the first customers. The typical scenario went something like this: Engineer has wonderful idea for computer (or peripheral), designs it on paper, builds a kludgy prototype, and places ads for it. Customers send in orders with checks (or bankcard number). Engineer uses money to buy parts and sets up assembly line in garage. Almost without exception, the computer designers were poor businessmen and ran into trouble making the shift from entrepreneur to business executive. Some did it with more grace than others, but the low survival rate of the pioneering companies in the field is evidence that running a successful company requires a different set of talents than designing a computer.

Nevertheless, these pioneers accomplished a tremendous amount. You may think that the Apple II (1977) was the first integrated com-

puter. Not so; the Sphere computer (1975) designed by Mike Wise contained the processor, keyboard, and display all in a case that looked very much like Hazeltine terminal or TRS-80 Model III. The Processor Technology Sol (1976) designed by Lee Felsenstein did not include the display, but it had the processor and keyboard in a single unit that was able to accept plug-in S-100 bus boards.

The Kit Era

But we're getting ahead of ourselves. Let's take a close look at several early personal computers available in 1975. One of the first, and certainly the most commercially successful, was the Altair 8800 designed by Ed Roberts of MITS. The computer itself was the same size and shape as existing minicomputers (19" x 19" x 10") and housed a motherboard, a front panel with switches and lights which indicated the contents of registers, a power supply, and up to 16 slots for the processor board, memory, and peripherals. The basic computer, in kit form, cost $429; assembled and tested, it cost $621.

It came without memory or interfaces. A 1K board cost $97, and a 4K board went for $264. Interface boards cost between $92 and $128 each. The only mass storage available was tape cassette; hence hobbyists became adept at listening to the horrible rasp of digital data on tape to determine the correct volume and tone settings for their recorders. MITS sold two types of terminal for the Altair, a Comter (CRT) kit for $760 and an ASR-33 Teletype for $1500. Most hobbyists sought out used teletypes which could be had for as little as $300 depending upon the condition.

The cheapest Altair configuration that could run anything other than machine code was an 8K system that MITS sold at a special $995 price. However, to that you had to add a cassette interface and recorder, and a terminal. Hence the total price of an 8K Basic-speaking computer kit was about $1900. Today, that sounds outrageous, but MITS sold thousands of these systems to hobbyists across the country.

The Altair used the S-100 bus, so named because it had 100 pins. In a very wise decision, Ed Roberts brought every signal of the 8080 microprocessor out on the bus; hence it was relatively easy to add memory and peripherals. As a result, companies like Godbout, Tarbell, Cromemco, Processor Technology, CMR, Dutronics, and Polymorphic brought out a wide variety of boards that plugged into the S-100 bus. Several of these companies would go on to manufacture computers —all based on the S-100 bus.

The only other early machine to use the S-100 bus was the IMSAI 8080, announced in December 1975. The IMSAI was virtually identical to the Altair except it had a much cleaner design. The subminiature toggle switches on the Altair front panel were replaced on the IMSAI by rocker switches. It had a much larger power supply, and the board layout was cleaner. Indeed, within a year, the IMSAI was actually outselling the Altair.

As people started adding peripherals to their Altairs, the limited capacity of the power supply reared its ugly head. Hence, Howard Fulmer brought out a beefy power supply to replace the original Altair unit. Ed Roberts had been attacking the board compatible companies, calling them parasites, so in a burst of honesty, Fulmer called his company Parasitic Engineering.

The Scelbi-8B was designed by Nat Wadsworth prior to the Altair. It was built around the 8008 chip, a less powerful processor than the 8080. A 1K machine in kit form was priced at $499. Unfortunately, Nat suffered several heart attacks in this period, dropped the computer project, and went into publishing software and books.

Mike Wise's Sphere 1 was an all-in-one computer built around the Motorola 6800 mpu. With 4K of memory, it sold for $860 in kit form, and $1400 assembled. Sphere was one of the few companies to offer floppy disk drives (8"). However, at a kit price of $6100 and assembled price of $7995, the company didn't sell many dual floppy disk Sphere 4 systems.

Another system built around the 6800 was the Southwest Technical Products 6800. This machine used an S-50 bus and was one of the first systems to incorporate a loader and mini-operating system (Mikbug) in ROM. With 2K of memory and a terminal interface, the kit sold for $450. SWTPC also made a terminal kit for use with any TV set priced at only $175. Dan Meyer's SWTPC is one of the few survivors from the early days. The company is still making 6800 and 68000-based systems, the majority of which are sold on an OEM basis to Fisher Scientific.

Like the Scelbi-8B, the Micro 440 was designed around a much less powerful chip than the 8080, the 4004. A kit with 256 bytes of memory cost $275. The Micro 440 never caught on, and its manufacturer, Comp-Sultants, was one of the first casualties in the field.

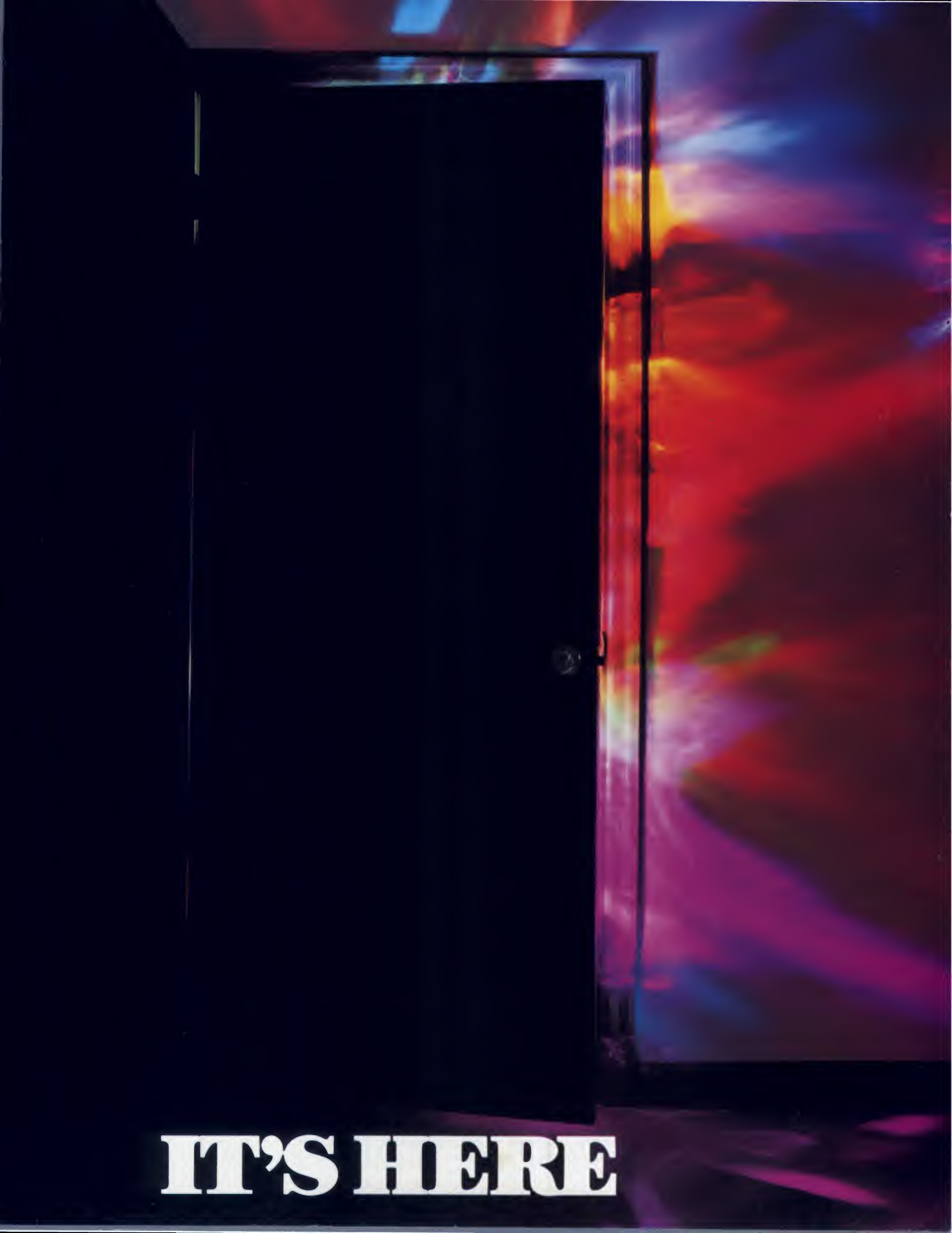
RGS sold primarily ICs and components, but in mid '75 announced a kit based on the 8008. It never went anywhere, and shortly thereafter RGS also went out of business.

> ***People were hungry for information, and new clubs were springing up like dandelions.***

Bare bones computer kits on a single board were quite popular in 1975, primarily because of their low price. In general, these units consisted of an mpu, less than 1K of memory, a numeric keypad with a few extra keys, say 20 total, and little else. Some of those available were the Martin Research Mike family, Microcomputer Associates Jolt, Iasis (Computer in a Book), Hal MCEM-8080, National Semiconductor SC/MP, and MOS Technology KIM-1.

Going into 1975, there were just two companies active in the microcomputer field: Scelbi and MITS. By the end of the year, the dream had spread like wildfire and there were 27 manufacturers, two magazines (*Creative Computing* and *Byte*), and ten user groups and clubs. Also, in 1975, Dick Heiser opened the first retail computer store in Los Angeles, and Paul Terrell opened the first Byte Shop in Mountain View. Bill Gates and Paul Allen wrote a Basic interpreter for the Altair, and Adam Osborne self-published *An Introduction to Microcomputers.* But the fun was just beginning!

So far, all the successful computers had been built around the Intel 8080 or Motorola 6800 mpus. However, Federico Faggin, designer of the Intel 4004, had broken off from Intel to form Zilog. Their first mpu was the Z80, a faster, more powerful version of the 8080. Meanwhile, MOS Technology had introduced another chip with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CO

INTRODUCING OKIMATE 10... THE FIRST

The printer in a class by itself.

It's here! The new OKIMATE 10 Personal Color Printer. The first color printer that lets you show off and tell all. The printer that lets you print all the information you can create with your Atari* or Commodore* computer. But with the remarkable ability to create original drawings and graphics as well, in over 26 beautiful colors.

A class act! The OKIMATE 10 gives you crisp, clean term papers, school reports and homework. Word processing capability means everything you do can be printed letter quality in minutes, instead of typed in hours. OKIMATE 10 color gives you the opportunity to print graphs, charts and pictures from popular graphics and drawing programs. OKIMATE 10's brilliant color means you'll shine, every time.

OKIMATE 10 feels right at home. Anywhere.

A special PLUG 'N PRINT™ package lets you plug your new OKIMATE 10 into your Atari or Commodore computer. And print. It's that easy. In minutes you'll be printing everything from soufflé recipes to needlepoint patterns. Party invitations to kitchen inventory. Love letters to gardening directions. At 240 remarkable words per minute. And not just in black and white, but in over 26 brilliant colors!

Financial statements will keep you tickled pink for very little green.

If you use your personal computer to keep track of mortgage payments, tuition payments, balance your checkbook or jump ahead of the Dow Jones', there's good news for you. You'll find that the new OKIMATE 10 gets down to business quickly. And easily.

A "Learn-to-Print" diskette and tape shows you how to set up your new personal color printer and start printing. A complete OKIMATE 10 Handbook will show you how you can take your imagination to places it's never been before.

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OR

PERSONAL COLOR PRINTER UNDER $250.

And while your imagination is soaring, you'll be glad to know that your new printer can keep right up with it! The new OKIMATE 10 is built with the same tradition of quality and manufacturing excellence that has made Okidata the most respected name in computer printers. Okidata craftsmen specially designed and engineered the new OKIMATE 10 to be incredibly small and lightweight. And they made it quiet as a whisper. But their imagination didn't stop there. To help you and your personal computer keep within your personal budget, they made the OKIMATE 10 available at retailers everywhere for less than $250. Something that should make every personal budget tickled pink.

Color your world.

If you've been playing games on your personal computer, now you can get serious and still have fun. The new OKIMATE 10 is completely compatible with a variety of software packages that will run on your Atari and Commodore with a simple disk drive. Just load and you're off and running. Plotting charts. Designing special graphs. Creating original illustrations and pictures. Drawing special graphics. And printing them all beautifully for everyone. On most kinds of paper. In over 26 beautiful colors!

QUESTIONS & ANSWERS

Q: Why do I need a printer?

A: You might as well ask, "Why do I need crayons?" When it comes to communicating, "putting it on paper" is still the best way to get your message across. You can have lots of computer equipment, but without the OKIMATE 10, it doesn't mean very much. Unless you get your letter, report, term paper or party invitation off the screen and down on paper, nobody's going to see it.

Q: What makes the OKIMATE 10 better than any other printer?

A: Because the OKIMATE 10 is unlike any other printer. First, it prints in COLOR. Up to 26 beautiful colors. Second, it prints up to 240 words a minute, so quietly you can talk in a whisper right next to it and still hear every word! And third, it prints letter quality, every time.

Q: What about graphics and pictures?

A: The OKIMATE 10 does it all. Graphs, charts, symbols, pictures, illustrations, and special drawings! With a compatible drawing package, anything you create on your screen can be printed in full color; a disk drive is required for color screen printing.

Q: What kind of paper can I use?

A: Just about any kind of smooth paper you want. From continuous feed computer paper to single sheets. From mailing labels to plastic acetate for overhead transparencies, the OKIMATE 10 prints crisp, clean, colorful images you'll be proud to send to friends, teachers, business associates, or frame and hang right in your own living room!

Q: Is the OKIMATE 10 easy to use?

A: As easy as "PLUG 'N PRINT!" No other printer is easier to use than the OKIMATE 10. Connecting the printer to your Commodore or Atari computer is, literally, a snap. The exclusive PLUG 'N PRINT package snaps into the printer. One cable connects it directly to your computer or disk/tape drive. Turn it on and you're in business. Once your OKIMATE 10 is up and running, the "Learn-to-Print" software program (included) teaches you printer basics—the "Color Screen Print" disk (also included) automatically prints everything on the screen in a single stroke. As a matter of fact, most of your printing can be done with just one command.

Q: What's the printer like in operation?

A: In one word: easy! Incredibly easy! The ribbon comes in a "Clean Hands" cartridge. So it's as easy to change as the tape in your audio cassette player.

Q: What about reliability?

A: Okidata has built the reputation of its complete line of printers on quality, dependability and rugged construction. The OKIMATE 10 is no exception. Don't let its light weight and compact size fool you. This printer is not a toy. It's a workhorse.

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Available at retailers everywhere.

an extended instruction set, the 6502. Chuck Peddle of MOS then decided to sell 6502 chips at the 1976 Wescon (a West Coast electronics trade show) for $20 each. The chips of other companies were priced much higher at the time; furthermore, most semiconductor manufacturers sold only to established accounts in large quantities.

One of the customers for Peddle's $20 6502 was Steve Wozniak, then a technician at Hewlett Packard. He had already designed an inexpensive home terminal that used a TV set for a display and the game of Breakout for Nolan Bushnell at Atari, but he had not designed an entire computer. Interestingly, he did not start with the computer itself, but chose first to write a Basic language interpreter for the 6502. When he finished that, he set out to make a computer on which to run it. A few weeks later, in the spring of 1976, he unveiled his computer, the Apple I, at the Homebrew Computer Club.

Talk about a bare bones computer! The Apple I had no keyboard, no power supply, and no case. But Steve Jobs and Paul Terrell were impressed with the machine. Jobs was impressed enough to form a company to sell them, and Terrell was impressed enough to order 50 units for his Byte Shop. There was just one problem—Terrell wanted the machines assembled. To pay for a PC board design, Jobs sold his Volkswagen, Woz sold his two HP calculators—their most valuable possessions. Woz kept his job at HP while Jobs hired his sister and Dan Kottke, a college student, to assemble the units. They were working under excruciating time pressure since all the parts they bought were on 30 days net; that meant they had to deliver the 50 machines to Terrell within 30 days. Terrell got his machines on the 29th day.

In the next few months, Jobs sold another 150 or so computers—mostly to stores in the Bay Area. The price for this little wonder was $666.

By the end of the summer, Woz was working on a design for the successor to the Apple I. It was to include a keyboard, power supply, and plug-in slots for peripherals like those found on the S-100 and S-50 bus machine. But perhaps the most important thing that happened to separate Apple from the rest of the field was not the computer—good as it was—but A.C. "Mike" Markkula. An engineer by training, Markkula also had solid business experience gained from time with both Intel and Fairchild during the meteoric growth period of both companies. Intel stock options had made him a millionaire, and at age 34, Markkula had retired.

One day, however, Markkula paid a visit to the garage of Jobs and Woz and was hooked. A few months later, Markkula put $91,000 of his own money into the venture and assumed an active role in planning and management. He hired Mike Scott as president and set out to get Apple listed in the Fortune 500 within five years.

Meanwhile, other designers were attracted to these two new chips as well as to the older ones. 1976 saw the introduction of Harry Garland's Cromemco Z-1 (a Z80-based assembled system with 8K, serial I/O, and resident monitor for $2495). Prior to that, Cromemco had been making some of the most interesting add-on boards for S-100 bus machines—the TV dazzler, digital to analog converter (allowed the use of joysticks), bytesaver, and camera/digitizer.

Perhaps the most important thing that happened to separate Apple from the rest of the field was not the computer—good as it was—but A.C. "Mike" Markkula.

Processor Technology introduced the Sol Terminal Computer, the Cadillac of small computers with solid walnut sides and heavy metal case. The basic machine for $995 (kit) came with 1K of RAM, 1K of video display memory, 1K of ROM, 85-key keyboard, serial and parallel interfaces, cassette interface, "personality" module, power supply, five slots for S-100 boards, and the Basic language on cassette. Processor Tech also introduced 16K RAM cards ($529 assembled) and a dual 8" disk system ($1895 kit or $2295 assembled). This was a rugged machine, but unfortunately Felsenstein had not designed it for ease of assembly. Thus, as the market shifted from kits to assembled computers, the factory assembled Sol was overpriced compared with the competition. This, coupled with the low reliability of the Helios disk system, eventually spelled the downfall of Processor Technology.

Another Cadillac design was that of Robert Suding's Digital Group computers. The Digital Group machines were among the first that could use different processors (8080, Z80, 6800) almost interchangeably, an interesting concept that crops up from time to time but that has never really caught on.

As the price of ROM and PROM chips continued to decline, manufacturers started building in loaders, monitors, and rudimentary operating

Key players in the early days of Apple included Steve Wozniak, Mike Scott, and Mike Markkula.

systems to make their machines easier to use. The Poly 88 from PolyMorphic Systems, Xitan from Technical Design Labs, Challenger from Ohio Scientific, Intecolor 8001 from Intelligent Systems, and several others all used this approach.

Also, in 1976, manufacturers were starting to offer an interesting range of S-100 boards and peripherals. Of course, memory boards were the bread and butter items with board manufacturers gaining an advantage by charging lower prices than the computer makers. In the add-on board market, companies like Seals, Solid State Music, Mini Term, Vector Graphic, Tarbell, Electronic Control Technology, and Morrow all made the scene. Computalker introduced a speech synthesizer; Comtek, a real time clock; and Percom, Midwest Scientific, and North Star all introduced floppy disk add-ons. Also in 1976, Gary Kildall's new company, Digital Research, announced the first advanced disk operating system, Control Program for Microcomputers, or CP/M. By the end of the year, the number of companies active in the field had topped 100.

Although there were 30 or so computers and a wide assortment of peripherals available, there was little software. Cromemco offered four programs to show off their TV Dazzler, and most manufacturers offered one or another version of Basic. However, there were no companies specifically in the software business, and most users typed in programs from magazines and books.

Howard Fullmer (L) and Gary Fitz (R) of Parasitic Engineering show off their new Equinox 100 computer at the first West Coast Computer Faire, April 1977.

People were hungry for information, and new clubs were springing up like dandelions with 132 in existence by the end of 1976. Some of the club newsletters were decidedly professional—among them, Interface put out by the Southern California Computer Society and the newsletter of the Amateur Computer Group of New Jersey. In addition to newsletters and meetings, clubs started holding conferences and shows, although honors for the first big microcomputer conference go to David Bunnell who organized the World Altair Computer Conference in March 1976. It was followed two months later by the first Trenton (NJ) Computer Festival organized by Sol Libes and the first Midwest Area Computer Club Conference which drew a staggering 4000 people.

The first national show was put together by John Dilks and held in a seedy hotel in Atlantic City, NJ. Nevertheless, the enthusiasm ran high, and attendees bought everything in sight. People were hungry for any information they could lay their hands on; the technical sessions were packed and magazines like *Creative Computing, Byte*, and the recently announced *Kilobaud* took thousands of subscription orders on the show floor.

The Move Toward Packaged Systems

Although most manufacturers offered their systems in both kit and assembled versions, the majority of their customers opted for the kit versions. After all, the kit was usually 25% or 30% cheaper than the assembled version—a significant amount considering the cost of a system in those days. However, three systems were announced in 1977 which swung the pendulum in the direction of assembled systems. Two systems were announced simultaneously on April 15 at the West Coast Computer Faire, the Apple II and the Commodore Pet, while the third, the TRS-80, was announced 3½ months later on August 3 in New York. Deliveries of all three machines started practically simultaneously in the fall of 1977.

I talked to Mike Markkula at the West Coast Faire. He explained the concept of Apple, "We want to be *the* computer company, not the small business computer company or something else—just *the* personal computing company. That's the reason you see a molded plastic case, Basic in ROM, and color graphics." I asked about memory, and Markkula opined the "4K of user space is more than adequate." At that time, an assembled Apple with 4K, two game paddles, and carrying case cost $1298.

The First West Coast Computer Faire put together by Jim Warren was an event to be remembered. Warren had figured on an attendance of 7,000 to 10,000. However, by 9:00 a.m. Saturday morning, two three-abreast lines stretched around the Civic Auditorium in San Francisco. It took over an hour to reach the door. By the time the Faire closed on Sunday, more than 13,000 people had jammed the aisles to talk to blue jean and T-shirt clad exhibitors. At one point the crush around the *Creative Computing* booth was so dense that people in back climbed on the shoulders of friends and waved dollar bills to get copies of the magazine. Other booths were equally mobbed as were the sessions given by speakers like Carl Helmers, Ted Nelson, Lee Felsenstein, and me. Virtually every active person and company in the industry was there, and from then on the West Coast Faire was the leading show of the industry.

Few people paid much attention to who was buying personal computers.

At that time, the main conference/trade show of the mainframe/minicomputer industry was the National Computer Conference sponsored by AFIPS (American Federation of Information Processing Societies). In 1976, I convinced the NCC organizers to set aside one day for personal computing sessions. I put together the sessions and invited speakers like Frederick Pohl (a science fiction author), Bill Mayhew of the Boston Children's Museum, and Scott Adams (who would later found Adventure International). The day was a great success, but it was not until 1978 that NCC formally recognized the importance of personal computers and included a Personal Computing Festival as a major part of the conference. Three years later when the personal computing portion of the conference equaled the size of the rest of it, AFIPS abolished it and rolled everything into one.

As mentioned previously, 1977 was really a turning point from kits to assembled systems. Neverthless, in the article, "Selecting a Micro," in *Creative Computing* in July, we discussed the five types of systems then available.

["Hi, we're from Europe. Where's the gold?"]

A SECOND CHANCE *to* GET *the* NEW WORLD RIGHT.

IF COLUMBUS HAD LANDED IN NEW JERSEY; if Cortez had been nicer to Montezuma; if Pizarro had been a more generous soul, would the world today be any different?

If you've ever wondered about things like that, you'll like *Seven Cities of Gold* very much indeed.

It's a kind of adventure. An unusually rich and technically impressive one with new continents to explore, natives to encounter, resources to manage and trade routes to establish. But beyond all the neat stuff *Seven Cities* throws up on the screen, there's something else happening here.

It feels quite odd to look at the map and see nothing. Of course you have to explore the more than 2800 screen new world in order to map it. But the way the natives act, the way you get older, the way seasons change and your men behave, and the way your reputation preceeds you gives you a sort of feeling that's unexpected in computer games. It's deeper. Maybe a little disquieting. It plays as much in your head as it does inside your computer.

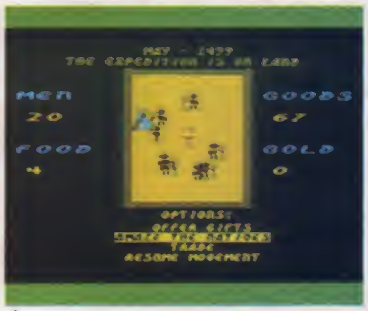
Seven Cities does all this with the real world or, better still (since the "new" world really isn't anymore), it will construct any number of completely detailed hemispheres for you to try your hand with.

Designed by Ozark Softscape (the people who made M.U.L.E., *Infoworld's* "Strategy Game of 1983"), *Seven Cities* is about as near a recreation of history as has ever been accomplished, with or without a computer.

Find it. Stomp around in it. See if you can't do a better job than all the celebrated figures who got us into the mess we have to deal with today.

This is Europe, in scrolling 3-D graphics. You outfit, visit the Crown, launch your ships, and if you're cut out for this, you return later to tell all sorts of wild stories about what it's like over there.

There are over 2800 screens to explore in the new world. As you scroll through them, seasons change



Animated natives surround you. They have no reason to trust you. The drum beat quickens.

Trading with the Aztecs is tricky. You could wind up with enough gold to build an empire. Or as soup.

Home again you view your maps, pat yourself on the back, and consider your place in history.

SEVEN CITIES *of* GOLD™

from ELECTRONIC ARTS™

MACHINE REQUIREMENTS: *Seven Cities of Gold* is available for the Apple II, II+, IIe & IIc, Commodore 64 and Atari home computers.

The least expensive were PC boards with 1K or less of memory and no I/O like the Jolt and SC/MP. Next were all on one board kits like the KIM-1, Intercept Jr., and Mike-3. A box with lights and switches was a big jump up; these included the Altair, IMSAI, and ETC-1000. Next were boxes with built-in loaders in ROM like the SWTPC 6800, PolyMorphic Poly-88, and Wave Mate Jupiter II. All-in-one assembled systems included the Compucolor 8001, Apple II, and Commodore Pet 2001. Of course, many of these were still sold in kit form. The powerhouse of electronic kits, Heathkit, also joined the fray with its H8 and H11 computers and H9 terminal.

Also making the scene in 1977 were five new magazines: *Personal Computing, Kilobaud* (later, to evolve into *Microcomputing*), *ROM* (survived nine issues and was merged into *Creative Computing*), *Dr. Dobb's Journal,* and *Microtrek* (survived only two issues). Also, *SCCS Interface* had evolved into a slick magazine that would become *Interface Age.*

Other interesting things proposed in 1977 included Hal Shair's idea for coin operated computers in public libraries. (The cost of computers dropped so fast that people could afford their own machines, and the idea died a quiet death.) A national computer club was proposed, and several organizing meetings were held, but the scheme had little to offer that users could not get from magazines and local clubs; it also died. Some researchers at Stanford and NJIT were promoting the idea of computer conferencing, but it was not until four or five years later that the price of modems came down enough to make the idea practical. Now, of course, CompuServe, The Source, and innumerable local bulletin boards demonstrate the practicality of the idea daily.

Lyall Morrill, Jr. (L) of Computer Headware showing his WHATSIT database package on a Sol at PC'78.

And Then There Was Software

In December 1977, there were only two advertisers of applications software in *Creative Computing.* One, Scientific Research, offered four 8" CP/M floppy disks, each containing a variety of text-oriented programs of widely varying quality. The other, Software Records, offered a 12" LP record of Basic programs that could be played "through your Tarbell, Kansas City, or Altair cassette interface." Of course, several book publishers—notably Sybex, Scelbi, and Creative Computing Press—were selling programs in book form. Also, in late 1977, Microsoft—then still in Albuquerque—placed its first ads for 4K and 8K Basic ($350) and Fortran ($500).

However, by mid-1978, scores of companies, offering an incredible array of software offerings, had sprung up across the country. Personal Software (*Microchess* by Peter Jennings and *Bridge Challenger*), Program Design Inc. (educational programs), Connecticut Microcomputer (word processing), *Cursor* (cassette magazine for the Pet), Adventure International (adventure games), Rainbow Computing (assorted Apple programs), Sensational Software (games and education), Computrex (utilities and games), Softape (speech phone tables), AJA (utilities), PRS (utilities), MicroPro International (word processing, sorting), Technical Systems Consultants (word processing, utilities), Tarbell (languages, utilities), Structured Systems (business), Lifeboat Associates (utilities), Smoke Signal Broadcasting (languages, utilities), Graham-Dorian (business), and Instant Software (games). Quick quiz: how many of these companies are still around today? Clue: you can count them on one hand.

Also in mid-1978, both Apple and Radio Shack announced $5^{1}/_{4}$" floppy disk drives, a move which threw open the floodgates for future software development. Then, in the fall of 1978, Dan Bricklin got together with Bob Frankston to produce the now legendary *VisiCalc.* Shown at the West Coast Computer Faire in April 1979 and NCC in June, *VisiCalc* became the first software package that would justify the purchase of an entire computer system.

There were several other milestones in the 1977-79 period. One, first uncovered by *Creative Computing,* were the scams pulled off by Norman Hunt (a.k.a. David Winthrop). In June 1977, *Interface Age* carried full page ads for boards and terminals from Data Sync Corp. in Santa Maria, CA. A month later, the same ads appeared in *Byte* and *Kilobaud*. The prices were irresistible, and the orders rolled in. However, it was all an elaborate con game, and Hunt was arrested and sent to prison for grand theft in late 1977. He escaped in February 1978 and shortly thereafter set up World Power Systems in Tucson, AZ.

This time Hunt was shooting for bigger stakes, and placed six-page inserts in *Interface Age, Byte, Kilobaud*, and, months later, *Creative Computing*. These ads showed all types of boards, disk drives, and memory add-ons, all priced about 20% less than the competition. The photos were of actual products of other companies with the manufacturer names stripped out and the negatives reversed. Realizing from a phone call that he had been uncovered, on April 25, 1979, Hunt loaded up a van with equipment, closed out his bank account, and left Tucson. As far as we know, he is still on the loose.

Also, during this period, the rapid growth of the personal computer industry lured several consumer electronics manufacturers into the business. Thus, we saw such products as the Bally Arcade, APF PeCos and Imagination Machine, Exidy Sorcerer, Interact, Video Brain, and, in mid-1979, the Texas Instruments TI 99/4 and Atari 400 and 800. Bally, APF, and Video Brain went straight to mass merchandisers completely bypassing computer stores and magazines. They even skipped the personal computer shows and exhibited instead at the Consumer Electronics Show (a trade show for mass retailers). As a result, they were the first to fail. TI and Atari had considerably more staying power due to a broader marketing approach and better financing.

The Market Starts to Divide

Through the end of 1978, few people paid much attention to who was buying personal computers. The shows were a hodge podge of exhibitors—chip houses, clubs, parts distributors, bookstores, T-shirt vendors, and every

imaginable type of computer, peripheral, and software manufacturer. Indeed, at one of the early West Coast Computer Faires, Lyall Morrill of Computer Headware wore a beanie with a propellor on it in a booth with hand lettered signs to promote his database program, WHATSIT (Wow! How'd All That Stuff Get In There?). The very next booth was occupied by IBM. The booth had fancy chrome display racks to show off the IBM 5100, but the three men in pinstripe suits mostly stood around watching hordes of customers, checkbooks in hand, line up at Morrill's booth to buy his program.

As I said, manufacturers didn't much care who was buying their wares. Just about everything was selling, and if a product turned out to be a dog, the manfacturer would simply throw in the sponge and start something else or join a more successful company. The cost of entry into the business was relatively low, and business plans were practically unheard of.

However, by 1979, things were changing. Venture capitalists discovered the industry and, in exchange for money, imposed some management discipline on the companies in which they invested. Second, larger manufacturers such as Radio Shack and TI were behaving like professionals. And third, word processing packages and *VisiCalc* were proving to business people that microcomputers were a justifiable expense.

As a result, by 1980, the industry started to take on a completely new character. Sure, there were still scores of garage shops and two-man operations—there still are today—but by and large the major players were beginning to conduct their business in a highly professional manner. For many companies this meant focusing on a specific type of customer. Thus, manufacturers of S-100 bus systems tended to move toward laboratory and business customers while manufacturers of less flexible, packaged systems moved toward home and educational customers.

This division was even more pronounced among software manufacturers. Although mid-1979, Personal Software, one of the industry leaders, had games, educational packages, and business software, by 1981 they had changed their name to VisiCorp and had all but dropped anything but business packages. Likewise, Programma and Automated Simulations (now Epyx) went heavily into games, while Edu-Ware and PDI specialized in education. (Brief aside: Programma was founded by Dave Gordon who overexpanded and bought every program in sight. Caught in a cash crunch, he sold out to Hayden. Disgusted with Hayden's financial controls, he walked out on his contract several months later and founded Datamost. In 1982, Datamost had more games on the market than anyone else, but in '83, they pulled more games than they introduced.)

Although the most costly hardware and software systems were targeted at business applications, in 1980, the really big volume was in games.

Nolan Bushnell, founder of Atari, had introduced his first coin-op game, Pong, in 1974. Three years later he entered the home market with Pong and Breakout and then, in 1978, introduced the Atari VCS (2600). This took the country by storm, and within a year manufacturers were marketing every imaginable form of game for personal computers.

Thus, in 1980, the sales of computer games began a meteoric rise that was, unfortunately, to last only two or three years for most manufacturers. The first games were text-oriented games converted from timesharing systems. In 1979, my book, *Basic Computer Games*, consisting of 101 games from timesharing systems, became the first million selling computer book. Scott Adams wrote a series of adventure games modeled after the classic Adventure game by Crowther and Woods, orginally written on a timesharing system at MIT. In addition, Lunar Lander, Star Trek, Space War, and many other popular games made the transition from timesharing systems to microcomputers.

Other early games were translated from coin-op games, the first smash hit being *Space Invaders* marketed by Creative Computing's software division, Sensational Software. However, within a year, literally hundreds of companies had entered the fray. Some of the best known were Strategic Simulations, Muse, Acorn, Aardvark, Quality Software, Broderbund, Krell, SubLogic, Dynacomp, Micro Lab, Synergistic, Avant-Garde, Beagle Bros., and Sirius.

Not all the games of these companies were good—indeed, the minute a good game came out, nearly everyone else brought out an "improved" version. Also, game publishers, buoyed by spectacular early sales and hampered by poor business planning, offered ridiculously high author royalties—in some cases 30% or more—and spent heavily on advertising and promotion. As a result, many companies did not survive, while a handful of game authors became instant millionaires.

Meanwhile, another handful of companies was following the same questionable strategy in the business and utility software market. Hence today there are more than 100 word processing packages, scores of spreadsheets, and dozens of database management programs, many of which represent only marginal improvements

> *In mid-1978, both Apple and Radio Shack announced 5¼" floppy disk drives, a move which threw open the floodgates for future software development.*

Paul Allen (L) and Bill Gates (R) of Microsoft with computers manufactured by some of their customers, including Radio Shack, Apple, NEC, Datapoint, and Commodore.

over competitive packages. The fallout has not come as quickly to these manufacturers since most of the packages are priced at $100 or more, but the signs of a shakeout are already evident.

The Entry of IBM

Going into 1981, there was no clear winner among suppliers of business systems. Major players included Apple, Tandy, Exidy, and even Commodore at the low to medium end. Higher up were North Star, Cromemco, Ohio Scientific, Intertec, Vector Graphic, Hewlett Packard, NEC, Midwest Scientific, and a large group of S-100 bus manufacturers. With the exception of the S-100 makers, most of whom offered the CP/M operating system, the others offered a bewildering array of incompatible operating systems: TRSDOS, Apple DOS, Flex, and other proprietary systems.

Applications software, too, had to be customized for each different hardware combination. For example, Michael Shrayer wrote no fewer than 78 different versions of his *Electric Pencil* word processing package for various mpus, operating systems, and video display boards. However, most software producers did not go this far and offered packages for only a limited number of machines.

More than anything else, success in the business market was determined by the strongest computer store in a local area. So much customizing was required between computers, peripherals, and software, that knowledgeable personnel were required to put a system together as well as provide after sale training and handholding. Indeed, stores became so important that several large stores and chains started buying boards and boxes and assembling their own systems. Among them were Prodigy from Computer Mart of New Jersey, Archive from GRC, and Vista from Advanced Computer Products.

However, all this was to change as a result of an announcement on August 12, 1981 at the largest press conference hosted by IBM since the introduction of the 360 in the mid 60's. The response by the press, by store owners, and by customers to the IBM PC was immediate and overwhelming. Our report in *Creative Computing* summed it up. "IBM has done just about everything right."

Looking back we can see some flaws—the limited 64K memory, single density disk drives, and expensive color graphics board—but at the time it looked great. People enthused over the 16-bit mpu, detached keyboard, 80-character text resolution, PC-DOS operating system, wide choice of applications software, and seemingly excellent documentation.

Although people were enthusiastic about the IBM PC very few people realized at the time the profound effect it would have on the market. In fact, there were even detractors; from the comments of industry pundit Adam Osborne at the West Coast Computer Faire in March 1982, one would have thought the entry of IBM was a non-event. (Osborne, of course, had introduced the Osborne 1 just one year earlier at the same West Coast Faire.) And Apple ran a full page ad in *The Wall Street Journal* with the headline, "Welcome IBM." Clearly, Apple did not regard IBM as a major threat.

At the risk of repeating an oft but seldom correctly told story, here is how IBM wound up with PC-DOS instead of CP/M. Prior to their first meeting with Bill Gates of Microsoft in July 1981, IBM, as is their custom, asked Gates (and Steve Ballmer) to sign a non-disclosure agreement. Gates couldn't see much point in it, but signed. After a second meeting in August, Gates signed a consulting agreement with IBM to suggest how the companies could work together—specifically to implement Microsoft Basic on the PC.

Demonstrating their lack of familiarity with the microcomputer market, IBM asked Gates if he could also sell them the CP/M operating system. Gates explained that he didn't own CP/M but that Gary Kildall of Digital Research was the man to see. Gates called Kildall and alerted him to the impending visit from IBM, which was then set up for the next day.

The next day, Kildall flew off on some previously scheduled business and asked Dorothy McEwen, who handled licensing agreements with hardware manufacturers, to deal with the IBM people. She greeted them but refused to sign the non-disclosure agreement because she felt it would put Digital Research in a vulnerable position. Company lawyer Jerry Davis agreed with her. The IBM representatives were rather miffed, turned around and flew back to Seattle where they asked Gates if he could supply an operating system as well as Basic.

Thus it was that Bill Gates got together with Tim Patterson at Seattle Computer Products and converted SCP's new operating system for the 8086, SCP-DOS, to MS-DOS for the 8088 in the IBM PC (IBM calls it PC-DOS). Once the specs of the operating system were fleshed out, IBM started making the rounds of applications software developers to arrange for conversions of software like *VisiCalac*, *EasyWriter*, the Peachtree business packages, and even Microsoft's version of *Adventure*.

IBM started shipping in September 1981 and by the end of the year had shipped 13,000 machines, a reasonable, but not staggering volume. However, over the next two years, IBM's volume kept climbing, and by the start of 1984 they had shipped an estimated 500,000 machines.

Right from the start, Apple instituted a policy of publishing both internal hardware and systems software specifications. This "open architecture" policy attracted third party vendors to market a wide variety of software and peripherals—much more than Apple could have produced internally. This seemed like a good approach to IBM and, in a major departure from corporate policy, they made available the specs of the PC to outside parties. As a result, software and peripheral manufacturers fell over themselves in a rush to offer add-ons and software for the PC.

Partially as a result of this great outpouring of software and partially because of the three magic letters, I, B, and M, other manufacturers beat a path to the door of Microsoft for its MS-DOS operating system. Less than one year after the announcement of the PC, the first PC compatibles were announced and, by 1984, there were nearly a dozen from which to choose. In addition to the compatibles, manufacturers of scores of other new 16-bit computers (Wang, DEC, TI etc.) also chose to use MS-DOS.

With this dominance of MS-DOS for 16-bit machines, things looked a bit glum for Digital Research since CP/M-86 (the 16-bit version of CP/M) was stalled in its tracks. Nevertheless, looking ahead to multi-tasking and multi-user systems, Digital Research announced Concurrent CP/M (recently renamed Concurrent DOS), a system that appears to have taken an early lead for multi-tasking applications.

As manufacturers increasingly followed in IBM's footprints, what happened to all the S-100 and other business computer manufacturers of pre-IBM days? Sad to say, the majority of them didn't make it. However, this shakeout—or competition, as we prefer to call it—was not limited to the high end of the market.

The Great Price War

In 1980 the dividing line between home and business systems was a murky one. Home systems tended to be priced from $400 on up while business systems were often the same computers with additional memory, peripherals, and software. Then at the Personal Computer World Show in September 1980, a red-headed genius from Cambridge, England announced the first computer for under $200. His name was Clive Sinclair, and the computer was the ZX80. A little over a year later, the ZX81 appeared with a price under $100.

Thus began the great price war of 1982-83. Although Sinclair may have been the catalyst, it was Jack Tramiel at Commodore who played the game with a vengeance. Although TI was his alleged target, his price cutting affected nearly every manufacturer (existing and new entrants) of low-end computers.

Briefly, the chronology went something like this. In the spring of 1982, the TI 99/4A was priced at $349, 16K Atari 400 at $349, and Radio Shack Color Computer at $379, while Commodore had just reduced the price of the Vic 20 to $199 and the C64 to $499. August '82: TI announces a $100 rebate (street price of 99/4A is now $199). October '82: Tandy cuts CoCo price $70, and Atari throws in an extra 16K free. A month later, Tandy cuts the price of the CoCo another $100. In December (having lost the holiday buying season to Commodore) Atari cuts the price of the 400 to $200 and 48K 800 to $500.

In January 1983, Tramiel slashes the price of the Vic to $139 and the C64 to $400. TI reacts a month later with a rebate that lowers the street price of the 99/4A to $149. Tramiel turns around and cuts the price of the Vic to under $100, forcing TI to drop the 99/2 project and announce a further cut in the price of the 99/4A to $100 to take effect in June, thus effectively halting sales for three months. Atari responds by cutting the price of the 400 to $89, actually selling machines for less than the manufacturing cost. Timex, who was the exclusive distributor of Sinclair computers in the U.S., cut the price of the ZX81 to $49, while Tandy cut the CoCo price to $199. TI, desperate by this time, gave production workers extended vacations and instituted an expansion box giveaway with the purchase of peripheral cards.

The Commodore Vic-20 and TI 99/4A figured prominently in the 1983 price war.

In June '83, Coleco entered the market with its Adam, an innovative machine with a daisy wheel printer, priced at $600 for the whole works. On June 10, 1983, TI announced the largest loss in their corporate history and three months later withdrew from the home computer market. Tramiel, still looking for market share, slashed the price of the C64 to $200 and virtually walked away with the 1983 holiday buying season for the second year in a row.

During this period, Mattel attempted to enter the market with the Aquarius, failed miserably, and, a year later, withdrew from consumer electronics altogether. Timex waited a year after the introduction of the Sinclair Spectrum in England to introduce it in the U.S. (as the 2068), also failed, and withdrew from the market. Milton Bradley invested heavily into voice recognition add-ons for the Atari and TI computers, and, facing enormous losses, was acquired by Hasbro. In 1984, Atari, struggling with a declining market for video games as well as losses in computers, was sold by its parent company, Warner Communications, to none other than Jack Tramiel who had recently left Commodore. NEC quietly withdrew their 6001 from the market, while SpectraVideo, APF, and Video Technology never got off the ground at all.

Although the price wars were most visible at the low end, competition was taking its toll at the medium and upper end was well. Some of the more notable victims included Osborne, Computer Devices, Vector Graphic, Victor, OSI, and Exidy.

Nevertheless, today there are more computer manufacturers than ever before, and the demise of one company seems to be followed by the entry of two new ones. Desktop computers were followed by transportables and, more recently, by notebook computers. Thus, the personal computer business remains one of the most exciting, alluring, and interesting businesses in the world. ■

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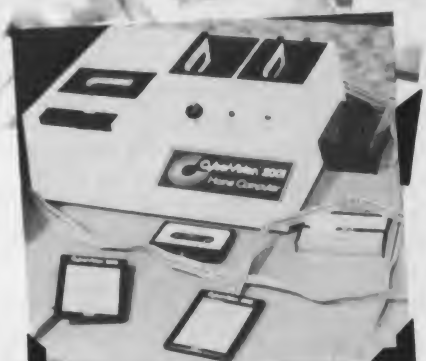
Jade booth at PC'78 in Philadelphia, August 1978.

David Ahl (L) talking to Alvin Toffler at the NY Personal & Small Business Computer Show, September 1978.

A regular exhibitor/visitor at the Trenton Computer Festivals is Steve Ciarcia of *Byte*, April 1981.



Cybervision home computer was first shown at the Consumer Electronics Show, June 1978. It never went anywhere.

Ted Nelson speaking at the first NCC personal computing sessions, June 1976.

Creative Computing exhibit at fourth Trenton Computer Festival, April 1979.

Lifeboat Associates was an early entry in marketing CP/M software. Bonita Taylor and Tony Gold talk to customers at PC'78.

Charlie Kellner demonstrates music synthesis on the Apple at CES, June 1979.

Peter Jennings, author of *Microchess*, at the Atlantic City show, August 1977.

Les Solomon, David Bunnell, and David Ahl at Sybex Computer Pioneer Days, June 1984.

Ohio Scientific showed several new Challenger models at NCC, June 1979.

JOHN J. ANDERSON

Prediction and Predilection:

Creative Computing and the Future of the Micro Industry

Let's cut right to the heart of the matter: the real problem with choosing the occupation of prophet is the extremely strong possibility of ending up completely, hilariously wrong.

There are carloads of amusing examples, many from extremely learned sources. Dr. Dionysys Lardner, for example, professor in the early 19th century of natural philosophy and astronomy at London's University College, asserted that "rail travel at high speed will never be possible, because passengers, unable to breathe, would die of asphyxia." Simon Newcombe is best remembered for his 1901 prediction that "flight by machines heavier than air is impractical and insignificant, if not utterly impossible." Eighteen months later, the Wright Brothers caught the breeze at Kitty Hawk. So much for the supposed experts.

I wonder if the teacher who told the young Albert Einstein he would never amount to much ever said to himself, "Boy, did I screw up!" I sure hope he did.

The one point to make of these examples is this: if you are going to err in predicting the future, err on the optimistic side.

I'm a World's Fair buff, so as far as I'm concerned, one good example here will suffice. At the New York World's Fair of 1939, in the very throes of the Great Depression, visitors to the General Motors Futurama exhibit were awed by visions of a shining future: airships and flying cars and glass skyscrapers 1000 stories tall, cities under the sea, and ribbons of superhighway 50 lanes across. The date of this coming glory? Why 1969, of course. The world of the *future,* you see, was only 30 years distant. Just as it

is easy for us to envision Scotty beaming us up in the year 2014.

Wrong Again

So we see how many ways there are to go wrong when predicting the future. You may be too biased in the direction of your own interests. You may be overly optimistic. Or you may be overly pessimistic.

Of course it seems difficult to be overly pessimistic these days. One wing of futurists gaining credibility by the minute are a group we may for convenience sake lump together as "the doomsayers." You know them: "The end is nigh." They have a point—just think of all the highly effective means we now have at our disposal to eliminate the future entirely! Nuclear holocaust, overpopulation, and pollution, just to name a few. Predictions of Armageddon have kept prophets busy for the last couple of thousand years, but will put them right out of business if and when they come true—typically short-sighted management, if you ask me.

Then there is the appositive wing, that holds technology itself to blame for all our problems. I call this group the "Neo-Luddites." They advocate a philosophy something along the lines of "Let's return to the dark ages, before it's too late!" They would stop the clock by pulling on its hands, like Harold Lloyd in "Safety Last."

Though I have made my share of predictions, right and wrong, in this magazine and elsewhere, I have always tried to take an active hand in shaping the future, rather than just "reporting" on it. I've been burned at it, too. Just last month the Atari column ended with an open letter to Jack Tramiel, urging him to market a certain new computer. A week after we went to press, the computer was picked up by Commodore. *C'est la guerre.*

Merely to predict is to attempt tc place yourself outside the process—very misleading, actually. For by the very act of prediction, you are attempting to mold the future to your personal vision—in fact predicting what you *want* to happen. In acknowledging my own ability to act, I can reject the line of doomsayers and of Neo-Luddites. My own philosophy is more along the following lines: "Don't sit there and mope over Malthus. Get off your keester and do all you can to prove him wrong. Even though you may admit he is right."

Okay, enough philosophy. Assuming we don't shortly burn ourselves out in some sort of apocalyptic flashdance, which, when I am feeling strong, I can bring myself to assume, there *are* some relatively safe predictions we can make—at least within a highly defined sphere. I'm going to go ahead and make a few here, somewhat conservatively, subjectively, and very much on the bias. I shall address them specifically to the microcomputer industry, including hardware, software, micros as a hobby, and finally the part I believe (desire) *Creative Computing* to play in coming years.

That's it for the qualifiers, folks. Now I'll start climbing out on the limb. Notice I never work with a net.

Bye-Bye Boom

As for the future of the industry, well, the first thing you should know is that the honeymoon is over. Passion sure ran high for a while—you could cut it with a knife. The love was unconditional, and computers were about to solve all of the world's problems. Why, folks who didn't have microcomputers were ashamed to admit it. They would say things like "I'm getting one next week," or "I bought an IBM, but it hasn't come in yet." Ah, those were the days—before the world wised up.

Now the boom is over. Not only is the industry faced with a sobered customer, it is faced by a customer with a positive hangover. Last night this poor fella was totally inebriated by the notion of the computer, but all that is left this morning is a headache, a ringing in the ears, and a vague crankiness whenever the word "diskette" is uttered.

Many of the so-called industry "experts" made a Futurama of the micro market. With straight faces they predicted sales of 90 million units in 1985 and other such drivel. Realities have dictated a different story. This has resulted in a very competitive, though stratified, marketplace. In response, the industry must mature.

One of my favorite analogies is the comparison of the microcomputer industry to the early movie industry. The days of Woz and Jobs—those were like the days of Mack Sennett and D. W. Griffith. Heck, even a decent two-reeler back then was big news. Things like pans, parallel-action cutting, dissolves, and fade-outs were being invented on the fly, and those who did the inventing more often than not had no idea of the significance of their acts.

Nowadays the big corporations have stepped in, and in a direct parallel to the fledgling motion picture industry, one by one all the little independents are being squeezed out. The last true visionaries and entrepreneurs of the micro industry will soon be dispossessed. And the unimaginative, lumbering moguls will have the game to themselves. The products will no longer be born of inspiration, but by formula.

And ultimately, the industry will lose its spark, but gain a new

sophistication. Forgive me the partisanship, but I'm quite convinced that the movie metaphor can be extended one step further: the coming of the Macintosh will do to the microcomputer business what the first talkies did for the film business. The Lisa was "The Jazz Singer," you see.

How can the market mature? It must offer systems that do more. It must offer systems that cost less. It must offer systems that are easier to use. It must continually offer innovation, as opposed to parochialism. And it must stop underestimating the customer.

See how easy it is to be a prophet? I wonder what the dues are in the Clairvoyant's Local.

Standard and Poor

Pardon my wrench, but the search for standardization is to my mind so much turkey too-toos. Has MS-DOS really done that much for the industry? Even the best MS-DOS programmers will tell you that MS-DOS is mediocre and that its main claim to fame was to aid the popularization of the relatively mediocre piece of hardware on which it was designed to run. Better to abandon a standard, if you ask me, than to converge around a lousy one.

And I don't think standards can ever be other than mediocre, because they are compromised by the very fact of their standardization. It is quite like TV catering to the eleven-year-old mind. Wonderful, if what you are trying to do is sell deodorant during commercials. Not so wonderful, if you are trying sell thinking between commercials. I know even eleven-year-olds who are insulted.

Lest you think I am making this piece into some sort of anti-IBM diatribe, let me set you straight. Some of my best friends own IBMs. Now that they have sent me a full-stroke keyboard for my PCjr, I may actually boot something up on it. Some people are so up on IBM—because of those three blue letters. Some people are so down on IBM—because of those three blue letters. I'm not anything because of those three blue letters. I'm down on mediocrity and up on excellence.

For you see, we are on the verge of choosing the next standard, since MS-DOS is about played out. We are coming to a crossroad, a watershed, a cusp, as it were.

My message is that we should not resist a little innovation—the heretical idea of trying something new. We must be willing to surmount our conformist urge to set arbitrary standards, in the hope of just maybe finding something better. It is a little like freedom of choice. Hey folks, this is America!

Smell the Coffee

It's America, all right, but we have already been passed, and we aren't even smart enough to wake up and smell the coffee. The Japanese already have us beat, while we bicker over whether they have us beat or not, because they are better tuned in to the secrets we preach but don't practice. You know: long-term planning, a healthier view of the market, a true commitment to R&D, to education, to new technology, to quality, to perfection, to personal accountability on the assembly line. That sort of stuff.

Of course if we fall into the mood to get our act together, we can knock their socks off. We can prove Alan Kay wrong in his recent prediction that the first working Dynabook will come from Japan. We can start our own Sixth Generation project. We can make a comeback in robotics. We can lead the way into the future, instead of following Japan's lead into the future.

And think of it: all we have to do is wake up and smell the coffee.

Future Stock

It's easy to tell you what is going to happen to hardware in the future. We will develop extremely powerful 16-, 32- and 64-bit CPU chips, requiring very little voltage and capable of operating at very high speeds (10 Mhz+). Custom VLSI chips will get bigger and bigger, and the day is not far off when entire motherboards, consisting of one or more central processors and multiple support processors, will be surface-mounted in a "board" that is actually etched as a single chip. This technology will start out expensively, but eventually bring costs down even lower than they are today.

Concerning RAM memory: it will continue to become cheaper and less bulky. CMOS technology will make volatile RAM a remnant of yesteryear. It will take only a trickle of voltage to maintain memory between power-ups. Once RAM is non-volatile, ROM becomes an antique. And new means of RAM storage will blur the line be-

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STARTED AN EVOLUTION:

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music collections, the Filer will memorize everything and know exactly where it is. To create a file, tell the Filer what goes in it and where, and then type away. You can even enter an entire list, then change its format without re-entering a thing. And a built-in calculator lets you do any necessary figuring as you go.

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The Bank Street College of Education, based in New York City, is known widely for its innovative work in early childhood and elementary education and as a national leader in the educational applications of microcomputers. Originally founded in 1916, the College has a long tradition of developing high quality educational materials and in 1980 established the Bank Street Center for Children and Technology.

Versions of THE BANK STREET WRITER are available for Apple, IBM-PC/PCjr, Commodore 64 and Atari Home Computers. THE BANK STREET SPELLER is available for the Apple II+/IIe/IIc only; Coming soon for Commodore 64. THE BANK STREET FILER and BANK STREET MAILER are available on Apple 64K II+, IIe and IIc computers only.

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CIRCLE 112 ON READER SERVICE CARD

tween RAM and conventional means of mass memory storage.

Mass storage itself will also make interesting strides. Hard disk technology will continue to miniaturize, and a 20 meg 3.5" drive will be realized within a few years. The 5.25" floppy will go the way of the 8" floppy—dinosaur city. The 1.5" floppy will of course be waiting in the wings—capable of storing 1 meg per side.

Want to talk about displays? Okay. The full-screen *color* LCD (80 columns x 25 lines in text mode) will make its appearance within a couple of years. In addition, dramatic new means of achieving flat-screen color will debut. The CRT is a long way from being outmoded, however. It will remain with us, relatively unchanged, for the next decade or two.

Miniaturization will continue along its current trend. Portable computers will eventually become the hottest segment of the micro market, and 1000K machines with 12 Mhz 32-bit processors, full-screen displays, and internal printers will weigh less than 10 lbs and cost less than $1500. Need a year on this? Try 1987 on for size. By 1990 no computer bigger than the Apple Macintosh will be selling well.

Software Soothsayer

It is much harder to be sure where the realm of software will be going as the '90s near. Much depends on the question of software standards, raised in a nutshell earlier on. The search is on for a new standard in multi-user operating systems. Big guns, including AT&T, are betting on Unix, and I have kidded more than once that if Unix becomes the next standard, I am leaving the industry to become a tuna fisherman. Unix makes me nauseous. It would be a fitting epitaph for the U.S. microcomputer industry if Unix were to follow MS-DOS as the next software standard.

So don't get me started on Unix. Allow me merely to say that it is an operating system that to my mind has long outlived its usefulness and is being kept alive only by respirator. I say pull the plug—software euthanasia. I'm sure we can dredge up something better than that diseased old fossil.

Without getting too hung up in buzzwords, I do think that *ease of use, integration*, and software that works *intuitively*, are buzzwords and phrases that will not fade with current fashion. They spell the direction of software for the future. And, I think the nested window/menu/mouse approach of the Lisa and Macintosh will become standards for future software to match.

Hobby Hoarse

When *Creative Computing* first got started, nearly all its readers were either educators or what you might term "enthusiasts." Nowadays, it is difficult to pin a label on the typical reader—he


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is certainly not a hacker—just a user. He doesn't explore the computer itself to pass the time, but uses it to run something else—a game, or business simulation, or personal productivity package, or other application of interest.

The hacker is still there, of course; he is just harder to find. He wishes he had a more powerful programming language. He wishes he had a smarter computer. He wishes it had more memory and more color and more animation potential. He wishes for better telecommunications potential and inexpensive hard disk storage. The low cost machine that satisfies these conditions will earn a niche in the future hobbyist marketplace.

On the software front, the enthusiast has grown quite difficult to please. He is not about to buy the next Pac-Man clone that hits the entertainment shelf simply because it is there. He wants something unique, something innovative, something hot, involving, and that shows off the very best capabilities of his machine. Software of that description has been rare lately, and many entertainment houses are hurting as a result.

I don't believe that "the bottom has fallen out" of the entertainment software industry, as other analysts have posited. I think the deadwood has taken a heavy toll and the market is ripe for some quality. When it appears, the packages will move.

Certainly there was a "fad" aspect to the consumer entertainment computer—a fad which by and large has passed. But the collective consciousness has been raised. The stage is set. Soon we shall see the next-generation magic machine.

The Role of Creative Computing

I have been thinking that it would be nice to make some declarations of principle in this, the tenth anniversary issue of *Creative Computing* magazine. Surely we have changed, and we will continue to change with the times. But we will never abandon the basic tenets of the philosophy that David H. Ahl brought to this, his magazine: that using computers should be fun; that learning about computers, too, should be fun; that a magazine is needed that can make those enjoyable aspects obvious and accessible; that computer users should be supported with software, applications, tutorials, and reviews; that 100% computer literacy should always be our goal; that we shall always "call them as we see them;" that we will do our reporting with humor and intellect; provide timely coverage of new developments; in-depth reviews of the hardware and software that really matters; provoke our readers to think; provide both sides of controversial issues; never be biased toward one piece of hardware; and display an ongoing commitment to human creativity with computers. We are, after all, the magazine with the word "Creative" in its title.

I don't have to hope the next ten years prove me right on that score. I *know* that to be true. ■

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JOHN J. ANDERSON

Dave Tells Ahl-The History of Creative Computing

Creative Computing is the oldest (and probably most beloved) magazine in the field of personal computing. But where did it come from? It simply didn't pop out of nowhere to become the "number one magazine in software and applications." In many ways the story of *Creative Computing* is the story of microcomputing. For from humble beginnings, it made its rise along with microcomputers themselves. And like the rise of the hardware and software it chronicled, the rise of *Creative Computing* was meteoric, often risky, and occasionally rocky. Ten years is a long time, you know. Twenty generations, if you clock it using industry standard time.

To try to answer the question, on this, the tenth anniversary of *Creative Computing*, I sat down with my boss—the founder, editor-in-chief, and head honcho around here, David Hollerith Ahl. He is a brilliant, yet enigmatic man, at his core actually rather shy. Surely you could make the case that he was in the right place at the right time. In 1974 personal computing was an industry just waiting to happen.

But Ahl was and remains to this day a visionary; he has for the last decade been hanging ten on the "Third Wave," as it were. Had he gotten his way at a board meeting over a decade ago, the first practical personal computers would have appeared in 1974 and sported the three letters DEC. When the mainframe priesthood was at the pinnacle of its power, Ahl was one of the original promoters of computer literacy for the masses. And from the start, he promulgated the idea that computers should be fun.

With uncanny powers of prediction, Ahl has brought the leading edge of technology to his readers. He reported on microfloppy disk drives in 1977, when 8" drives were considered state of the art. He told his readers about laser discs back in 1976, predicting their ascendency and use as computer storage devices. In 1979 *Creative* reported on the basics of window-nesting. CD audio disks were known to Ahl's readers as early on as 1981.

And from the beginning, Ahl geared his magazine in a manner that has engaged the very best minds. In their book *Fire in the Valley*, Paul Freiberger and Michael Swaine define the air of *Creative Computing* as "intellectually playful." That is the essence of a truly creative environment— and that is why he chose the name *Creative Computing.*

So where did this guy come from, anyway?

The Formative Years

The story of *Creative Computing* really begins with a somewhat nerdy seventh grader in Malverne, NY, a community on the south shore of Long Island. It was 1950, and David H. Ahl had just entered Malverne Junior-Senior High School. He found himself in the homeroom of Natalia Dugas, a science teacher. Ahl recalls having a bit of a crush on Miss Dugas. He joined the school photography club simply because she was the club advisor.

On a fateful spring day in 1951, Miss Dugas took the club on a field trip into New York City by bus and subway. They walked all the way from Battery Park to 42nd Street, snapping shots of everything as they sauntered uptown.

Ahl's main recollection, however, was downtown, around the mouth of the financial district: Cortlandt Street, to be specific. The area he remembers so fondly was vaporized back in 1964 to make room for the World Trade Towers. To those who frequented it, it was known as "Radio Row."

From that day until he went off to college, Ahl made regular trips to the magical marketplace that was Radio Row. Tenement storefront after storefront piled exotic wares on rickety wooden sidewalk stands. Most of it was World War II surplus; much of it was out and out junk. But all of it was electronic: aircraft radios, bombsights, amplifiers, oscillators, relays, solenoids, transformers, mercury switches, rheostats, gyroscopes, diodes, vacuum tubes, rows of pushbuttons, crystals, resistors, tuners, and scads of things that were desirable precisely because their functions were unknowable.

Tinkering with the cheap parts he brought home in

Dave Tells Ahl-
The History of Creative Computing

cardboard boxes, Ahl started to learn. Soon he was building the projects described in magazines like *Popular Electronics* and *Radio/TV News.* Within six months, he had taught himself enough to start a small business repairing radios.

Always starved for decent tools, Ahl undertook an essay contest "Why I Like RCA Instruments," undaunted by the fact that he had never touched an RCA instrument. To his surprise, the essay was good enough to win him an RCA vacuum tube voltmeter. Now he was ready to experiment.

With his ninth grade classmate Tod Dixon, Ahl invented a device they dubbed the "Radio Teletype." This amazing kludge was a typewriter with a solenoid attached to every key. Each solenoid was activated by a relay and oscillator, and each key had its own frequency. One working unit was completed, but work on a second was abandoned. Ahl says the idea "sort of worked," though all tests were conducted under heavily experimental conditions. But Dixon moved away, and Ahl moved on to other things. The project was abandoned.

In addition to electronics, Ahl's other passions in high school were mathematics (captain of the math club) and Boy Scouts (Eagle Scout by tenth grade). Although he was active in sports, clubs, and church groups, he was never particularly popular and recalls himself as a "square." Nevertheless, his grades and active participation in extracurricular activities earned him a full tuition college scholarship from Grumman.

Explorer Scout group showing their homebrew ham rig, October, 1952. (David Ahl standing foreground.)

Ahl entered the School of Electrical Engineering at Cornell University in 1956. He breezed through the first year and a half, but in junior year his grades plummeted. He failed AC Machinery—a notoriously tough course—and was about ready to throw in the sponge. Of course in 1958 dropping out of college was not nearly as fashionable as it is today. Ahl's parents were pretty upset, and with David visited the school to talk to Dean William Erickson.

Ahl looks back at that one hour conference as a major turning point in his life. "Erickson told me," says Ahl, "that I could master any subject at all, including AC Machinery, if I would just use my brain to *think* rather than memorize. He was understanding, but not in the least bit gentle. He gave me the determination to succeed." Though his grades did not rebound immediately, by senior year Ahl was selected for Eta Kappa Nu, the EE honorary.

Cornell and Computers

In the late 1950's, Cornell experimented with a five-year engineering program which gave its graduates the equivalent of both a BS and a BA degree. Thus, students in this program had much greater exposure to liberal arts and humanities courses than typical engineering students. The program has since been abandoned, but Ahl felt it was worthwhile because "it gave us a much broader perspective on the role of engineering in the world than we would have had otherwise. Far too few graduates nowadays have a good understanding of their roles in the greater scheme of things."

In 1957, Cornell installed its first computer. It was an early Burroughs experimental model, installed in the ME school. Only two computer courses were offered, and Ahl took both of them. "They barely scratched the surface," Ahl recalls. However, for his fifth year project course, Ahl wrote a computer program to aid in the acoustic design of rooms. It took account of the shape of a room, absorbency of surfaces and objects, reverberation and echoes. "It was an interesting project," says Ahl, "because it showed me that computers could do more than crunch numbers; they could simulate a real-world environment."

During junior and senior years, Ahl spent his summers working in the fledgling computer group of Grumman Aircraft. He remembers one unbelievably dull summer. "All I did was write programs to calculate the distortion coefficient of radar signals passing through a radome at various angles. But the following summer ('61) was great! Our group was writing programs to simulate practically everything about the Orbiting Astronomical Observatory, years before it was built and launched."

Grad School and Beyond

Having decided against engineering as a career, Ahl entered the Graduate School of Industrial Administration at Carnegie-Mellon University in 1961. In contrast to Harvard or Wharton, GSIA takes a much more quantitative approach to management. Computers were a part of many courses, and Ahl soon learned about the mysteries of linear programming, queueing theory, production-line scheduling and gaming theory as well as the more traditional managerial psychology, accounting, finance, policy formulation, and law.

As part of an assistantship, Ahl was asked to help write segments of the management game (a simulation of


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Dave Tells Ahl- The History of Creative Computing

competition in the detergent industry). He also translated it from Gate, a low level assembly-type language of the Bendix G-15 computer, to a then-new high level language, called Fortran. As with his acoustics project at Cornell and satellite simulations at Grumman, Ahl was most fascinated by computer simulations of aspects of the real world.

Upon leaving CMU, Ahl joined the Army Security Agency for his two-year ROTC tour of duty. He describes his days attached to the 82nd Airborne at Fort Bragg as "one day's experience repeated 730 times." In between exercises with names such as "Swift Strike" and "Desert Strike," he nevertheless managed to take some short courses and picked up touch-typing as well as IBM 650 assembler and Cobol programming.

Computerizing Market Research

After his hitch, Ahl joined with a former professor who had just geared up a market research consulting company, called Management Science Associates. Ahl found himself handling clients like Scott Paper, two divisions of General Foods, Hershey, and Hunt-Wesson. The company was primarily involved with the analysis of consumer panel data, and Ahl wrote a series of programs to forecast the sales of new products dependent upon the trial and repeat purchasing behavior of test panel families. Within several years, his model became the standard of the industry; it is still in widespread use today.

In 1969, Ahl joined Educational Systems Research Institute where, once again, he was involved in the writing of computer programs to simulate real world processes—this time the success of vocational school students based on courses taken, grades, and a host of other variables.

During these years in Pittsburgh, Ahl had been attending night courses at the University of Pittsburgh, toward a Ph.D. in educational psychology. Unfortunately, he was a few credits and a dissertation shy of another degree in early 1970 when he left Pennsylvania to join Digital Equipment Corporation (DEC) in Maynard, MA.

Educational marketing group at DEC, 1971 with the new EduVan. L to R: Val Skalabrin, Gerry Hornig, Mark Bramhall, Betsy Pyne, and manager David Ahl.

DEC and Education

As a result of his background, Ahl was brought aboard by DEC to conduct formal research in the minicomputer market. However, when the vice president who hired him left DEC a few months later, Ahl had to find a new home. Hence he joined the PDP-8 product group with the mission to market computers to educational institutions—a market he had identified in his market research role as having very good potential.

Although colleges saw the need for computers, there were three serious obstacles to be surmounted in minicomputer sales to elementary and secondary schools in the early 1970's. First was the price; a typical single user system cost upwards of $10,000, before mass storage. Then there was the question of a suitable high level language. DEC had written a language called Focal, a marvelous interactive version of Algol; however, Dartmouth was promoting the use of Basic on the Dartmouth timesharing system (DTSS) and this was the best known project providing terminals to secondary schools. The third obstacle was the lack of applications software.

Prices were coming down and Ahl wasn't in a position to do much about that anyway, so he concentrated on the second and third obstacles. Since the DEC software development group wasn't the least interested in Basic, Ahl contracted with several outsiders to write Basic interpreters for different hardware configurations. "People always asked why Basic was different on all our machines," says Ahl. "My goal was to get the product out as fast as possible; if I had been a stickler for consistency, it would have taken another two years."

To overcome the lack of applications software, Ahl adopted a multi-pronged strategy. First, he bought books and programs from outside vendors, packaged them together in a big box, and gave this kit to each and every school that purchased a DEC computer. Ahl called this total system—hardware, systems software, and applications software—an EduSystem. This was the first bundled system offered by DEC, and perhaps by any computer manufacturer.

The second prong of attack was a newsletter called Edu. This was designed to be an interchange of information among all of DEC's educational customers—about 300 at the time. Ahl expected the newsletter to achieve a circulation of 2000-3000 (about ten per computer site). However, within 18 months, the circulation of Edu topped 20,000. "What happened," explains Ahl, "was that educators with non-DEC computers needed the very same information—so they subscribed too. I realized, too, that people used Edu to help decide whether to buy at all. It dawned on me then what a wonderful idea it would be to do an educational computing magazine that wasn't wedded to one particular computer manufacturer."

Boy, have you taken a wrong turn. One moment you're gathering treasure and the next you're being eyed like a side of beef.

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*Game Manufacturers Association, 1981

Dave Tells Ahl-The History of Creative Computing

Publisher turned peddler at the MACUL conference, Grand Rapids, MI, April 1978.

But the realization of his idea would have to wait a year and a half.

Ahl next wrote a series of booklets containing problems from textbooks, an explanation of how each could be solved with a computer, and a program to do so. The publication of these problems led to articles in various educational magazines (*The Mathematics Teacher, The Science Teacher*) and presentations at educational conferences.

In 1973, the U.S. economy was turning soft, and DEC responded in the same way as many other companies—with an order to cut expenses. In Ahl's Educational Product Line, that meant "relocating" two people. Ahl balked at this directive and so his group manager, Ed Kramer, decided that one of the people to be cut should be Ahl himself.

Ahl remembers the day quite well. "It was February 22, 1973. I was planning to go to New York to celebrate my father's 65th birthday and his retirement. Just before I was about to leave, Ed called me in and handed me a letter of resignation—my letter of resignation—and asked me to sign it. I was absolutely stunned. In a daze, I signed the letter and left for New York. I said nothing to my parents—I didn't want to spoil their celebration—but about halfway through what should have been a very happy dinner, I just burst into tears, and the whole story came tumbling out."

In a rather strange turn of events, a few days later, Dick Clayton, vice president of R&D at DEC, asked Ahl to join his group. "I was back on the payroll before I was ever off. In my new position—I don't think I had a title—I was able to pull together some loose ends. I wrote a 24-page brochure for RSTS, a system with magnificent capability, but that few people in the field really understood. I also put together a bunch of games I had written and collected from others and put them into a book, *101 Basic Computer Games.* Six years later, in 1979, this became the first million-selling computer book ever."

The most interesting projects Ahl worked on were two prototype stand-alone computers. One was based on the VT-50 terminal and had a PDP-8/A computer crammed into the base of the unit. The other was based on the PDP-11 and was designed to fit into a very deep attaché case. It also sported a small floppy disk drive. "I don't recall the exact size," says Ahl, "but it was smaller than the then-standard 8" drive. Unfortunately, it never worked very reliably." Ahl also explored the possibility of marketing these systems through various retailers of high-end products such as Hammacher-Schlemmer and Abercrombie & Fitch and marketing of kit versions through Heathkit.

Ahl presented a plan for further development of these products to DEC's operations committee on May 17, 1974. "The managers were divided right down the middle. The engineering guys loved it, but the salespeople were afraid it would disrupt DEC's normal sales patterns. It fell to Ken Olsen (president of DEC) to make a decision. I'll never forget his fateful words, 'I can't see any reason that anyone would want a computer of his own.' In all fairness, Ken's thoughts were that anyone could have access to a powerful timesharing system and thus didn't need an individual PDP-8."

"Nevertheless, I was devastated. When the next headhunter called, I said OK, I'm ready. I left DEC in July 1974 and joined AT&T as Education Marketing Manager."

Had DEC gone ahead with the project, and marketed a stand-alone computer in 1974, it is likely that they would have dominated the personal computer industry—and that the entire industry would have developed quite differently.

AT&T and Creative Computing

As soon as Ahl made up his mind to leave DEC, he started laying the groundwork for *Creative Computing.* He announced intentions to publish the magazine at NCC in June 1974 and over the next few months contacted prospective authors, got mailing lists, arranged for typesetting and printing, and started organizing hundreds of other details.

In addition, he also moved his family to Morristown, NJ, and settled into his new job at AT&T. He had little spare capital, so he substituted for it with "sweat equity." He edited submitted articles and wrote others. He specified type, took photos, got books of "clip art," drew illustrations, and laid out boards. He wrote and laid out circulation flyers, pasted on labels, sorted and bundled mailings.

By October 1974, when it was time to specify the first print run, he had just 600 subscribers. But Ahl had no intention of running off just 600 issues. He took all the money he had received, divided it in half, and printed 8000 copies with it. These rolled off the presses October 31, 1974. Ahl recounts the feeling of euphoria on the drive to the printer replaced by dismay when he saw two skids of magazines and wondered how he would ever get them off the premises. Three trips later, his basement and garage were filled with 320 bundles of 25 magazines each.

He delivered the 600 subscriber copies to the post office the next day, but it took nearly three weeks to paste labels by hand onto the other 7400 copies and send them,

Dave Tells Ahl-The History of Creative Computing

unsolicited, to libraries and school systems throughout the country.

He repeated this strategy of overprinting and using the extras for promotion for the next three issues and then decided to skip the July/August issue with the hope of catching up.

By August 1975, circulation had edged over 2500, but Ahl was faced with the prospect of worrying about renewals. More important, in January 1975, the first MITS microcomputer, the Altair 8800, was announced, and Ahl thought that it might represent a good alternative to a minicomputer for schools. Thus, Ahl started looking for people to write about this new breed of microcomputers.

Moreover, many of the first purchasers of microcomputers found that there wasn't much information on how to use them, short of making the lights on the front panel blink. They turned to *Creative Computing* with its tutorials and applications programs in Basic, and by mid 1976 the magazine was running material for two overlapping audiences educators and hobbyists.

Not knowing much about the magazine business, Ahl had not known the importance of advertising; nor had he counted on it. Amazingly, even without any advertising, by the end of the first year of publication, the magazine was actually making money. Of course, it was printed on a ground wood (newsprint) stock and was not paying any salaries at the time.

However, by late 1976, it was apparent that advertising was necessary for future growth, and Ahl decided the publication should "go slick." Hence, the November/December 1976 issue was printed on coated stock, and the doors were thrown open to advertising.

By 1978, circulation hit 60,000, roughly one-third educators and two-thirds hobbyists. Financial projections indicated that the total revenue would soon hit the $1 million mark, and Ahl decided it was time to leave his day job (by then he had been promoted to manager of marketing communications for the Bell System). He resigned from AT&T in July 1978, incorporated the company, and got down to some really serious planning for future growth.

Although Ahl had established Creative Computing Press in 1976, it had published just three books. He had started a mail order book service to handle the books of others, but it was floundering. Ahl had also started a software division (Sensational Software) to develop and market software for small computers, but it was resting on dead center.

In August 1978, Ahl acquired *ROM* magazine and two small newsletters, all of which were integrated into *Creative Computing* . In January 1979, he increased the publication frequency to monthly and published the first eight software titles, as well as two more books. In 1980, he started a hardware distributor, Peripherals Plus, acquired *Microsystems* magazine, and started *SYNC* magazine.

Having outgrown its original rented quarters in downtown Morristown in 1979, Ahl bought a two-family house to house the overflow. Having recently been divorced, he was planning to live in one half of the house. However, by the time the house was ready for occupancy, all but one single room was needed for the company. Ahl has mixed memories of the nights when Ted Nelson was editor. "Ted used to come in at 5:00 p.m. or so and work all night long. That was okay, except his word processor had a noisy Qume printer, which was located in the kitchen directly below my bedroom. I'd tell Ted every night to wait until morning to print his stuff out, but Ted would forget and, almost without fail, the printer would start up at 3:00 a.m."

"The other problem with having the system in the kitchen was that the IMSAI computer developed a habit of resetting itself whenever the refrigerator door was opened. But the house was fun," continued Ahl. "It gave us a feeling of camaraderie and it was a nice place for our Friday afternoon wine and cheese parties."

Today, *Creative Computing* is a rather different company. A new 25,000-square foot building was acquired in October 1980, but the big change came in 1981 when the company was acquired by Ziff-Davis Publishing Co.

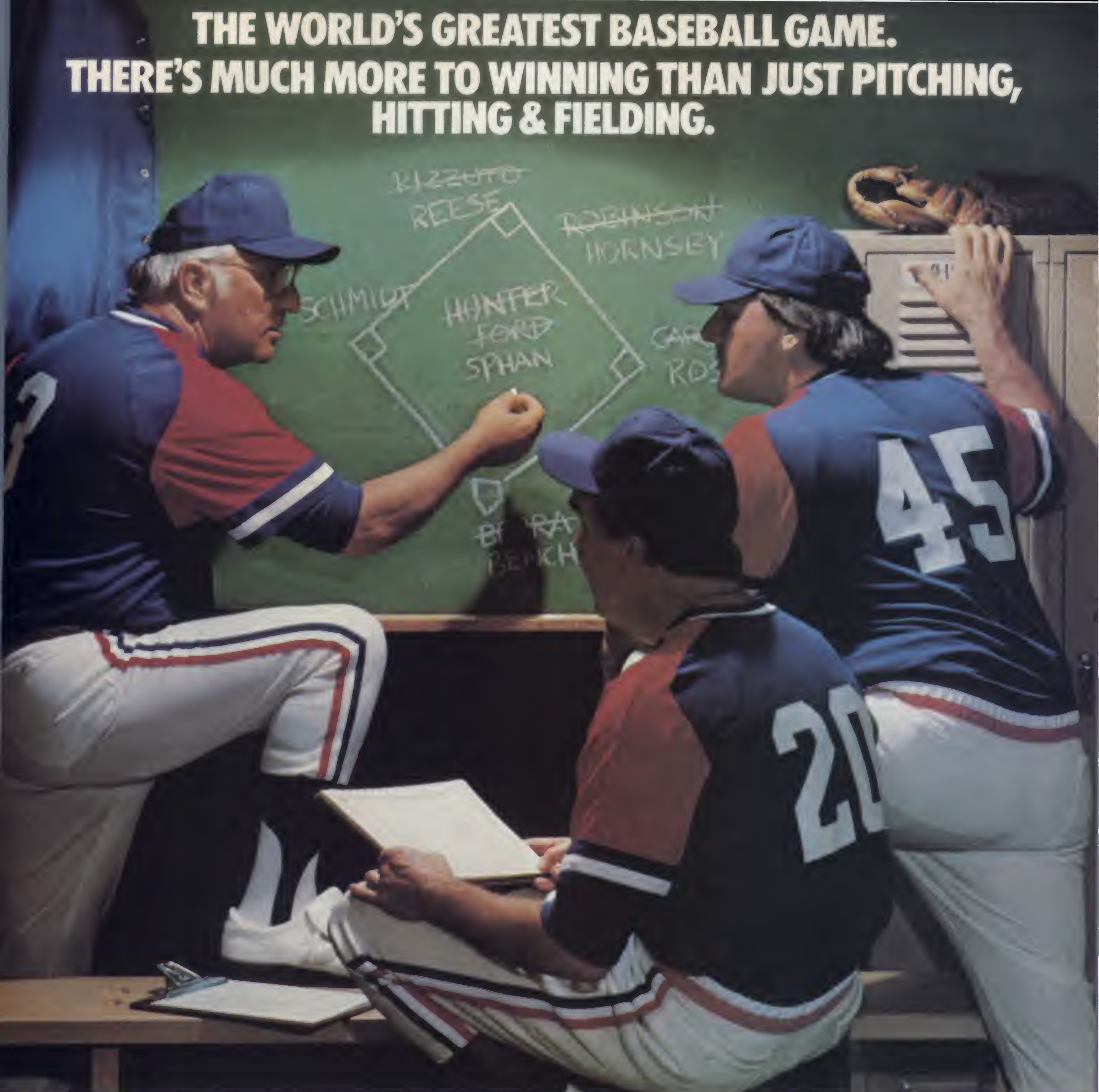
In 1979, the large, established publishers began to notice this new industry and, with the purchase of *Byte* by McGraw-Hill, most of them decided to move into the area. "There was no way we were going to be able to compete with the million dollar circulation and advertising budgets of CBS, ABC, Hearst, and the others," said Ahl. "Furthermore, we had no clout on newsstands; we'd get shoved to the back row or not put out at all when the biggies came along. Hence, it seemed like a sensible move to merge with Ziff."

Ziff purchases paper by the train load and puts 28 magazines on newsstands every month. They have seasoned, sophisticated circulation and advertising sales departments. And they keep a close eye on profits. As a result, they immediately shut down Creative's software division, Peripherals Plus, and education center. They sold *Small Business Computers* magazine and shut down *SYNC* the day Timex announced it was withdrawing from the computer business.

As for *Creative Computing* itself, the editorial content is still fully under the control of Ahl and his staff.

Where is the magazine going? In the future as in the past, the direction probably will continue to evolve with the industry; indeed, it will probably lead the industry. *Creative* started as an educational magazine but quickly expanded its coverage to include hobbyists. When packaged systems came along in 1978, it shifted again with the market and covered the most popular applications—games and graphics. Today, it has further evolved to covering applications in business and personal productivity. "Because we've been around so long," said Ahl, "many people think we're the same today as when they picked up their first copy. To some people we're an educational magazine; to others, a hobbyist magazine; and to still others, a games magazine. If the only issue you saw was August 1984 (the Japan issue), you might think we were a competitor to *Fortune.* Actually, we are all of these things and more."

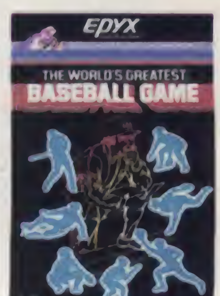
"Our goal is to be the very best general computer magazine in the world. That means honest, in-depth reviews of hardware and software. It means interesting applications, understandable tutorials, thought-provoking articles, meaty columns, and perhaps some whimsy. It means that every issue won't be the same, but every issue will be stimulating, interesting, and, we hope, memorable." ■



Real baseball is more than just hitting, pitching and fielding. It's also your favorite major league teams, the great stars of today and the All-stars of yesteryear. It's statistics and coaching, and it's managing your own game strategy. With the World's Greatest Baseball Game, you have it all. Pick your major league line-up using the actual player and team stats. Then watch the action unfold against an opponent or the computer.

Two modes let you choose between managing and controlling your team or managing only. The World's Greatest Baseball Game—everything you could ever want except the hot dogs and peanuts.

One or two players; joystick controlled.



EPYX™ COMPUTER SOFTWARE

Strategy Games for the Action-Game Player

CIRCLE 144 ON READER SERVICE CARD

Creative Computing in

▲ When the magazine outgrew Dave Ahl's basement, he rented a (not very) converted warehouse at 51 Dumont Place two blocks from his posh AT&T office for $400 a month.

▼ Steve North (on ladder) and other employees worked weekends to make the building habitable.

▶ The first floor was a warehouse for back issues, books, and software ably overseen by shipping Supervisor Ron Antonaccio.

◀ Upstairs was a large room occupied by the Customer Service, Order Processing, Circulation, and Accounting Departments.

▼ A considerably smaller room served as an office for Betsy Staples, then business manager for the growing company, and Publisher David Ahl. Note state-of-the-art Sol 20 computer and not-so-state-of-the-art air conditioning/ventilating system in the background.

▲ In the center of the cluster of second-floor rooms was the software development center and editorial testing lab. Chairs were always in short supply.

Pictures

When the company outgrew the building on Dumont Place, a two-family house at 93 Washington Street, Morristown, was purchased to augment the dwindling supply of office and storage space. Again, employees pitched in and accomplished the move over the Washington's Birthday holiday weekend.

Within 18 months, both of the company buildings were bursting at the seams, so with the help of the New Jersey Economic Development Authority, Dave bought a 25,000-square-foot building in nearby Morris Plains. Once again, employees handled the move and even undertook some serious renovation.

The annual company picnic is always supervised by Ron Antonaccio (left), but by June of 1981, the company had grown so large that we won't attempt to identify the others in this picture—there are too many we don't remember.

There was an open house to christen the new building. Editor Ted Nelson (left) made a special daytime appearance to introduce himself to employees like then Editorial Assistant Peter Fee and Bob Callan of the software division.

Associate Editor John Anderson was the new guy at the June 1982 picnic. Karyn Hecht (foreground) spent the summer dodging darts in the editorial bullpen.

Hayes. Leading the way with quality telecomputing systems for the personal computers that businesses use most.

When it comes to communicating—computer to computer—Hayes says it best. All you need is a Hayes Smartmodem (it's like a telephone for your computer) and Smartcom II® software, to get you into all the right places.

In no time at all, and with no assistance at all, you can create, send and store files, and automatically log on to information services. The communication possibilities are endless!

Introducing our new Smartcom II. More connection capabilities. More convenience.

Now Hayes goes even further to streamline your communications and optimize your connections.

Smartcom II software is currently available for more than 16 personal computers (with even more to come). That means you can communicate, Smartcom to Smartcom, with an IBM PC, DEC Rainbow 100, HP 150, TI Professional Computer* and others.

And that's not all! Smartcom II also emulates the DEC VT100 and VT52 terminals, now in widespread use in many businesses. This feature lets your personal computer "pretend" it's a DEC terminal, opening the door to a vast installed base of DEC minicomputers!

We stand on protocol.

In addition to the popular Hayes Verification protocol, the new Smartcom II also includes the XMODEM protocol, ensuring accurate transmission to a wide range of personal computers and mainframes at information services. By matching the protocol (or "language") of a remote computer to yours, Smartcom II can transmit information error-free, regardless of interference on the phone lines.

Voice to data—in the same call!

With Smartcom II, you can easily switch from voice to data transmission (and back again), all in the same phone call. This saves you time and money, since you don't have to hang up and dial again.

Your Hayes telecomputing system works—totally unattended.

Smartcom II makes telecomputing simple, even when you're not there. It allows your Smartmodem to receive a message for you when you're out, and leave it on your disk or printer. And you can tell Smartcom II to "save" the messages you've created during the day, and automatically send them at night, when phone rates are lowest.

Get your hands on the leader.

With an unsurpassed record of reliability, it's a small wonder Smartmodem is such a smart buy! Smartmodem 300™ (the first of the Smartmodem series) dials, answers and disconnects calls automatically. Smartmodem 1200™ and Smartmodem 1200B™ (it plugs into an expansion slot inside an IBM PC or compatible), provide high-speed, high-performance communications for businesses of all sizes.

And when Smartmodem is purchased with Smartcom II, you have the most dependable telecomputing system available for your personal computer.

Everything we do at Hayes is designed to make communications easier for you. Feature-rich, direct-connect modems. Menu-driven software. Concise documentation. *And* a customer service organization, second to none!

See your dealer right now for a hands-on demonstration of Smartmodem and our latest version of Smartcom II. From the telecomputing leader. Hayes.

Hayes™

Hayes Microcomputer Products, Inc.
5923 Peachtree Industrial Blvd.
Norcross, Georgia 30092 404/441-1617.

CIRCLE 151 ON READER SERVICE CARD

CHRONOLOGY BY **DAVID H. AHL**

Ascent of the Persor

1974

Intel announces the 8080 microprocessor
Motorola announces the 6800 microprocessor
Nat Wadsworth markets Scelbi-8H computer kit

David Ahl publishes first issue of *Creative Computing*
Ted Nelson publishes *Computer Lib/Dream Machines*
Radio Electronics publishes plans for Mark-8 computer

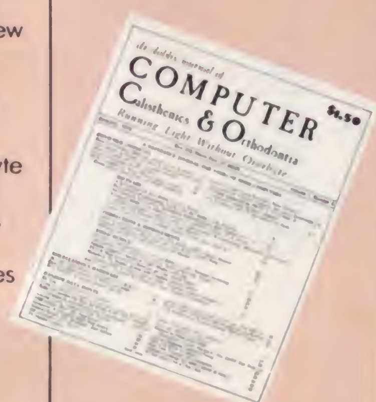
1975

Ed Roberts' Altair 8800 kit is featured in *Popular Electronics* cover story
Cromemco founded; introduces PROM programming board
Processor Technology founded; introduces video display board
Polymorphic founded; introduces A/D board
Wavemate founded; introduces Jupiter II kit

IMSAI founded; introduces 8080 computer
Sphere founded; introduces line of 6800-based computers
Southwest Technical Products introduces 6800 computer
Bill Gates and **Paul Allen** write Basic for the Altair
First computer clubs founded (**Homebrew** in San Francisco, **SCCS** in Los Angeles, **ACGNJ** in New Jersey)
Dick Heiser opens first retail computer store in Santa Monica
Paul Terrell opens first Byte Shop in Mountain View
Wayne Green publishes first issue of *Byte*
Adam Osborne publishes *An Introduction to Microcomputers*

1976

Zilog announces Z80 microprocessor
MOS Technology announces 6502 microprocessor; **Chuck Peddle** sells them at Wescon for $20 each
Processor Technology introduces Sol
Cromemco introduces Z-1 microcomputer
Steve Wozniak designs Apple I; Apple founded by Wozniak and **Steve Jobs**
George Morrow founds MicroStuff (later Thinker Toys and Morrow Designs)
Steve Leininger joins Radio Shack to design a computer
Gary Kildall founds Intergalactic Digital Research (Intergalactic dropped later); introduces CP/M
Michael Shrayer announces *Electric Pencil*
David Bunnell organizes World Altair Computer Convention
John Dilks organizes first national trade show in Atlantic City
David Ahl organizes first personal computing sessions at NCC



First issues of *Dr. Dobb's Journal, SCCS Interface*
100 companies active in field by year end
132 computer clubs in existence by year end

1977

Commodore announces Pet designed by Chuck Peddle
Apple II announced
Radio Shack TRS-80 announced
Heathkit announces H8 and H11 computer kits
North Star Horizon announced
Vector Graphic announces S-100 system
Technical Design Labs announces Xitan
Ohio Scientific announces line of Challenger computers
Ed Roberts sells MITS to Pertec
Structured Systems announces CBasic
Scientific Research sells first applications software disks
Software Records announces 12" LP of programs
First **Microsoft** ads for Basic and Fortran
Scott Adams founds Adventure International
Jim Warren organizes First West Coast Computer Faire
First **Computerland** franchise store opened in Morristown, NJ; 24 stores open by year end
First issues of *Kilobaud, Personal Computing, ROM, Microtrek*
Over 200 active manufacturers by year end

1978

Atari announces the 400 and 800 computers
Exidy announces the Sorcerer

al Computer

Video Brain computer introduced

More than 20 S-100 bus computers announced

Alpha Micro announces 16-bit S-100 boards

Apple and **Radio Shack** announce 5¼" disk drives

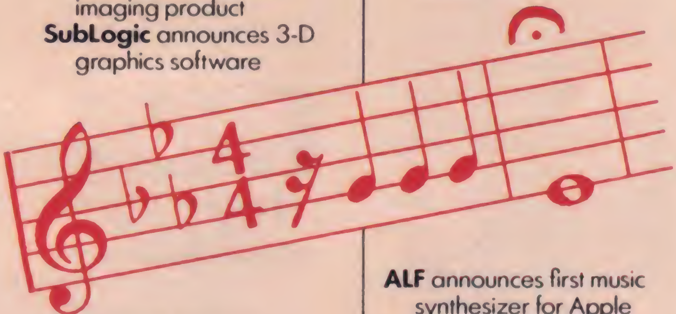
Ithaca Audio (later, Ithaca Intersystems) founded; announces memory chips for TRS-80

Houston Instruments announces HiPlot plotter

Summagraphics announces Bit Pad, first digitizer

Micro Works announces Digisector, first video imaging product

SubLogic announces 3-D graphics software



Personal Software founded; announces two games packages

Ed Zaron founds Muse (Microcomputer Users Software Exchange)

Computer Headware announces Whatsit database manager package

MicroPro International founded; announces *Word-Master* and *Super-Sort*

Dan Bricklin and **Bob Frankston** write *VisiCalc*

Micro Systems Services announces Dial-A-Program (software by phone)

NCC holds first Personal Computing Festival

1979

Texas Instruments introduces 99/4

Radio Shack announces Model II business computer

APF introduces the Imagination Machine

Mattel announces keyboard unit for Intellivision

Commodore offers a standard keyboard with the Pet

First Apple knockoff, the Orange, shown at West Coast Faire

ALF announces first music synthesizer for Apple

Heuristics introduces Speechlab, first voice recognition system

Hayes announces Micromodem 100

Novation introduces the Cat acoustic modem

Automated Simulations (now Epyx) offers first package, *Starfleet Orion*

MicroNet announces CompuServe service

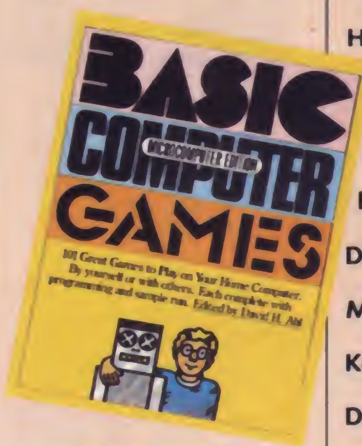
The Source founded

Microcomputer Industry Trade Association formed

Introl announces first home control system

MicroPro announces *WordStar*

Sesame Place Theme Park includes a computer center



David Ahl's *Basic Computer Games* becomes first million selling computer book

1980

Sinclair ZX80 introduced—first computer under $200

Radio Shack introduces the Color Computer

Hewlett Packard introduces HP-85

Apple introduces the Apple **III**

Epson announces the MX-80

Exatron introduces "stringy floppy" tape system

Digital Research introduces CP/M-86

Microsoft agrees to work with IBM

Ken Williams founds On-Line Systems

Doug and **Gary Carlston** found Broderbund

Personal Software introduces *Zork*

Xerox, DEC, and **Intel** announce Ethernet

Ascent

Near banishment from **NCC** for American Used Computer (for sandwich board signs) and *Creative Computing* (for taking subscriptions)

Creative Computing does giant 74-page April fool parody section

1981

Osborne introduces the first transportable computer

Commodore announces the Vic-20

IBM announces the PC

Microsoft produces MS-DOS (PC-DOS)

Bally computer acquired by Astrovision; re-introduced with Z-Grass

Okidata introduces Microline 82 printer

First color printers announced

Sirius Software founded

Big Five Software founded

Zork relinquished to game writers at **Infocom**; *Zork II* introduced

Logo finally licensed for commercial release by TI and others

1982

Commodore 64 announced

Epson announces HX-20, first notebook computer

Grid announces Grid Compass

Wang announces Professional Computer

DEC announces Rainbow 100, Professional 325 and 350 computers

Kaypro announced

Apple announces Lisa

Franklin introduces Apple compatible Ace 100

NEC announces 16-bit Advanced Personal Computer

Toshiba announces T-100 computer

Seven IBM "compatible" computers announced

More than 20 companies announce expansion boards and hard disks for IBM PC

Teleram announces first S-100 bubble memory systems

Sony announces 3½" microfloppy drive

Japanese Fifth Generation Project launched

Three colleges require students to have personal computers

Peak year for computer games—more than 300 introduced

Software Arts announces *TK!Solver*

First integrated software packages announced—*Context MBA* and *Lotus 1-2-3*

1983

IBM announces PCjr and PC XT

Radio Shack announces Model 100; **NEC** announces 8201

Sharp announces PC-5000

Epson announces QX-10 computer with Valdocs

ACT announces Apricot

Atari announces 600XL, 800XL, 1200XL, 1450XL computers

Coleco announces Adam

SpectraVideo announces 318, 328 computers

Mattel announces Aquarius computer

Timex announces Timex/Sinclair 2000; withdraws from market eight months later

Androbot announces four home robots

14 Japanese **MSX** standard computers introduced; none sold in U.S.

TI announces Professional Computer, CC-40 Portable

TI withdraws 99/4A

Osborne Computer files for Chapter 11

Four Atari VCS-to-computer conversion units announced; none successful

American Bell exhibits at West Coast Computer Faire

Number of personal computing magazines tops 150; starts to decline

PC publishes largest monthly magazine in history with 774 pages

1984

Apple announces Macintosh, Apple IIc

Hewlett Packard introduces Model 110 Portable

Commodore announces 264 (now the Plus 4)

ACT introduces first upward compatible line of seven computers

Amiga announces Lorraine

Mattel, Timex, Spectra-Video, Victor, Actrix, Computer Devices leave market or sell out

Warner sells Atari to Jack Tramiel

Electronic software distribution systems introduced

First national TV advertising for software (*Lotus Symphony* and Ashton-Tate *Framework*)

Human Edge Software introduces first psychological analysis packages

Peak year for educational software

Number of software manufacturers tops 500

Strategy-arcade game for the whole family!

Fat City

Developed by Optimum Resource, Inc. Designed by Richard Hefter and Steve Worthington. (For the Apple and Atari computers with 48k and disk drive.)

You run a crane for the Fat City Wrecking Co. Your job: knock down deserted buildings in 10 cities. But beware! The old buildings are occupied by a bunch of nasty rats. And they're going to bombard you with cans, tomatoes and rocks as you slam your wrecking ball into their crumbling homes.

Can you batter the buildings before running out of fuel? Can you rub out the rampaging rodents? Fat City is a game everyone in your family is going to love. Says Softalk: "A great deal of thought went into its development as its excellent playability attests. The game incorporates super graphics and strategy, fun and a new idea. The combination could well prove addicting."

Look for Fat City in finer computer stores everywhere. Or, order by calling toll-free 1-800-852-5000, Dept. AJ-5. Only $39.95.

Fat City
Weekly Reader Family Software
A division of Xerox Education Publications
Middletown, CT 06457

CIRCLE 235 ON READER SERVICE CARD

OUR ARCADE GAMES WE BROUGHT

Bally Midway's Spy Hunter puts you in the driver's seat of the hottest machine on four wheels. You're after enemy spies. The situation is life and death. You'll need every weapon you've got – machine guns, and guided missiles, oil slicks and smoke screens. But the enemy is everywhere. On the road, in the water, even in the air. So you'll have to be more than fast to stay alive in Spy Hunter. You'll need brains and guts, too.

Do you have what it takes?

Bally Midway's Tapper would like to welcome you to the fastest game in the universe.

You're serving up drinks in some of the craziest places you've ever seen. And the service better be good, or else. You'll work your way through the wild Western Saloon to the Sports Bar. From there to the slam dancing Punk Bar and on into the Space Bar full of customers who are, literally, out of this world.[1]

Are you fast enough to play Tapper? If you have to ask, you probably already know the answer.

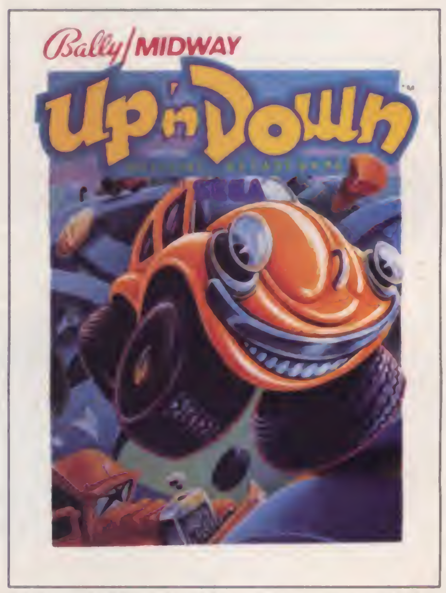
Bally Midway's Up 'N Down by Sega. In this game, a crash is no accident.

In fact, it's the whole object of the game. You'll race your baja bug over some of the worst roads south of any border. Leap dead ends, gaping canyons and oncoming traffic in a single bound. And if anyone gets in your way, crush 'em.

Crashing, bashing Up 'N Down. It's one smash hit that really is a smash.

The #1 Arcade Game of 1984.

Nominated as Most Innovative Coin-Op Game of 1984 by *Electronic Games* magazine.



#1 Arcade Hit, *Play Meter* Conversions Poll, 8/1/84.

WERE SUCH BIG HITS, THEM HOME.

Sega's Congo Bongo rocked the home game world when it shot up to Number 3 on the Billboard chart this summer.

And now it's available for even more home systems. So check the chart and get ready for jungle action. You'll pursue the mighty ape Congo up Monkey Mountain and across the Mighty River. Do battle with dangerous jungle creatures. Ride hippos, dodge charging rhinos and try to avoid becoming a snack for a man-eating fish.

Congo Bongo. It's fast and it's fun. But be careful. It's a jungle in there.

Sega's Zaxxon. If you haven't played Zaxxon, you must have been living on another planet for the past few years.

And now the ultimate space combat game is available for even more home systems. You'll pilot a space fighter through force fields and enemy fire on your way to do battle with the mighty Zaxxon robot. Countless others have gone before you in this Hall of Fame game. But this time your life is in your own hands.

Zaxxon killed them in the arcades. But compared to what it will do to you at home, that was child's play.

	SPY HUNTER	TAPPER	UP 'N DOWN	CONGO BONGO	ZAXXON
Atari 2600 cartridge	✓ NEW	✓ NEW	✓ NEW	✓	✓
Atari 5200 cartridge				✓	✓ NEW
Atari Computers* cartridge	✓ NEW	✓ NEW	✓ NEW	✓	✓ NEW
Atari Computers† diskette	✓ NEW	✓ NEW	✓ NEW		✓
ColecoVision & ADAM cartridge	✓ NEW	✓ NEW	✓ NEW	✓ NEW	✓
Commodore 64 cartridge	✓ NEW	✓ NEW	✓ NEW	✓	✓ NEW
Commodore 64 diskette	✓ NEW	✓ NEW	✓ NEW	✓ NEW	✓
Apple II, IIe, IIc diskette	✓ NEW	✓ NEW	✓ NEW	✓ NEW	✓
IBM PC diskette	✓ NEW	✓ ** NEW	✓ NEW	✓ ** NEW	✓ ** NEW

Arcade and Home Smash. Hit #3 on *Billboard* magazine's Top Video Games survey.

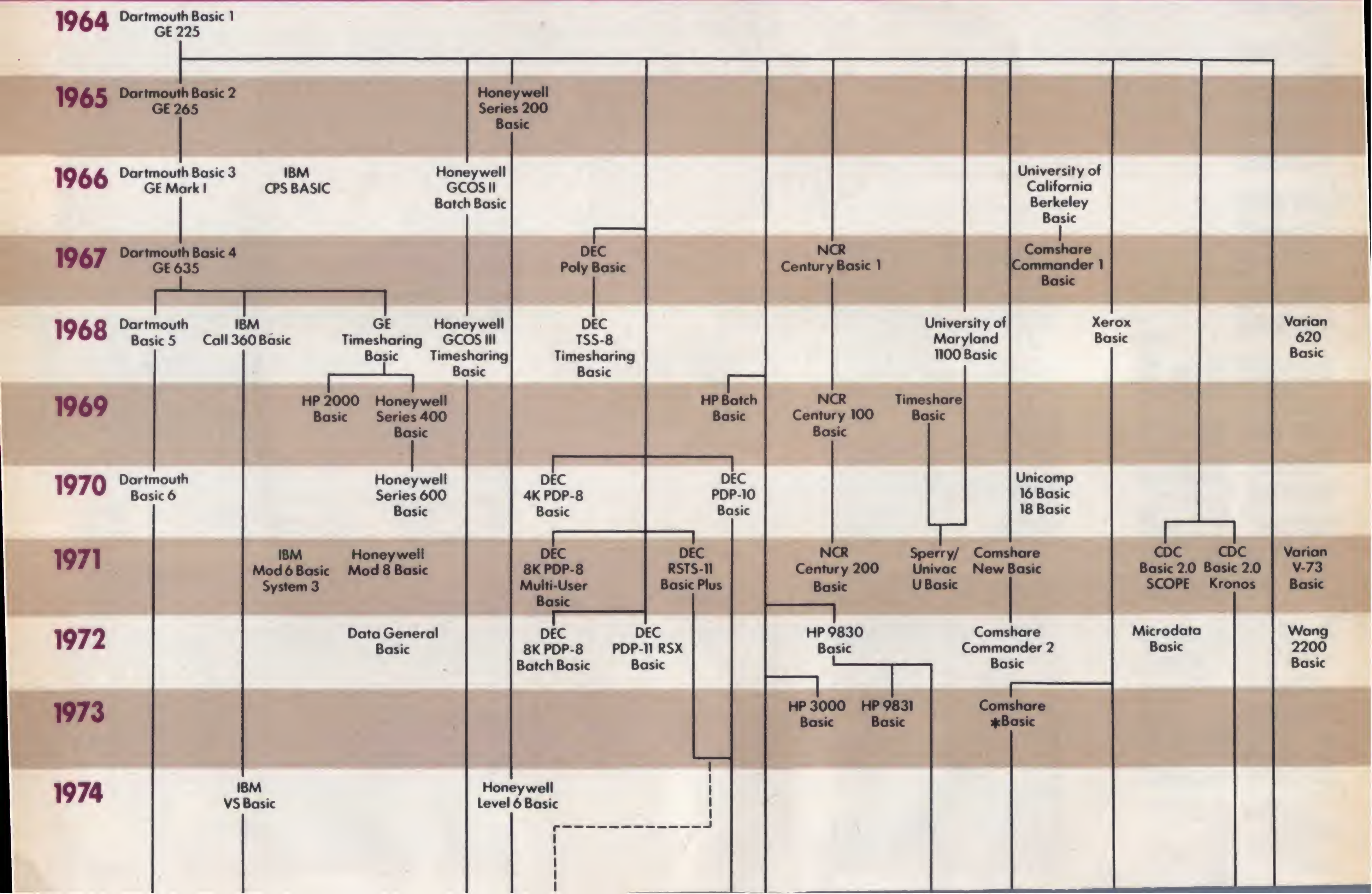
One of only ten games ever to make *Electronic Games'* Hall of Fame.

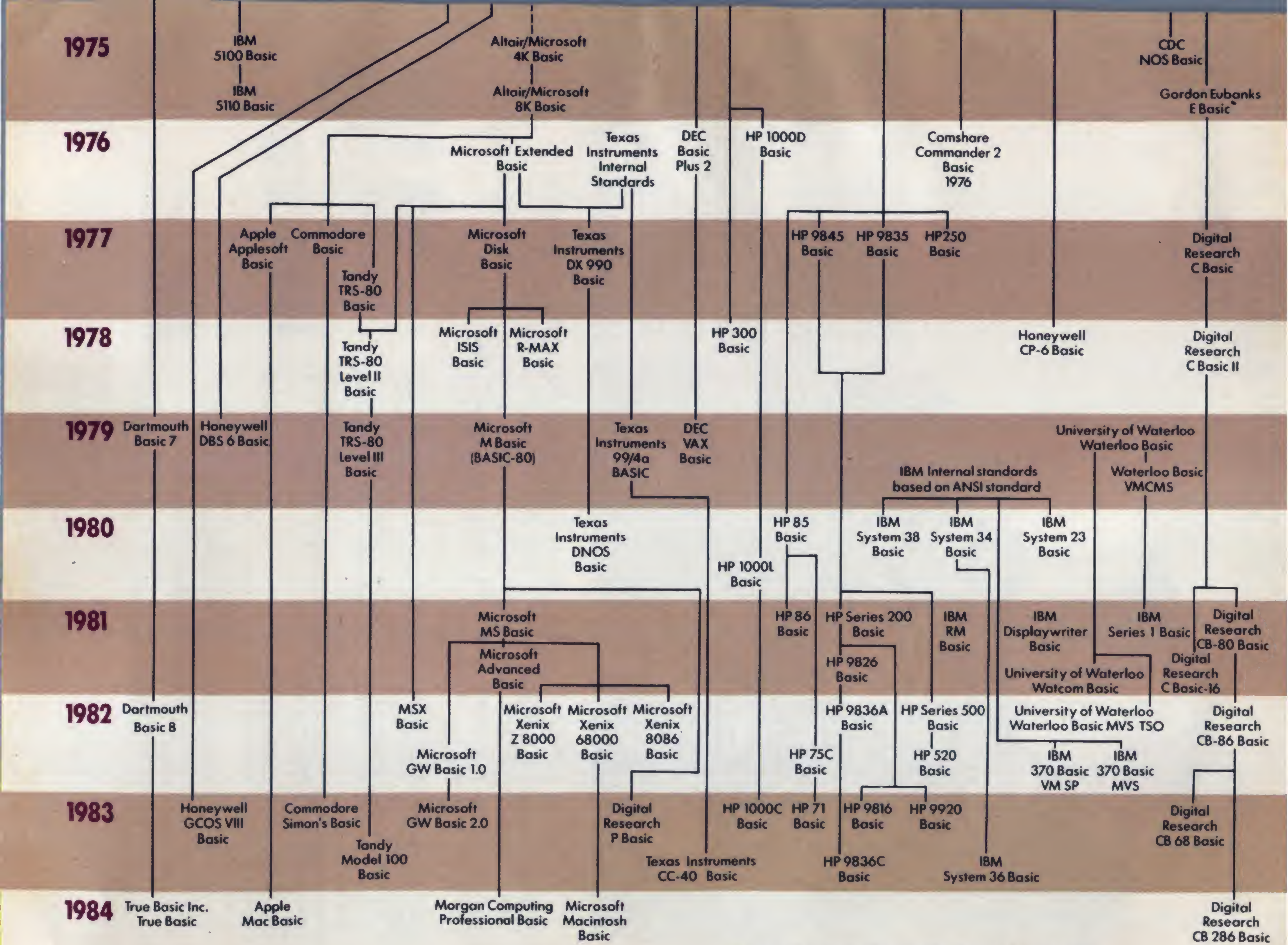
✓ Published by Sega Enterprises, Inc.
✓ Published by Datasoft, Inc. under license from Sega Enterprises, Inc.
✓ Published by Coleco Industries, Inc. under license from Sega Enterprises, Inc.
✓ Published by Synapse Software Corporation under license from Sega Enterprises, Inc.
*Atari 400, 800, 600XL, 800XL and 1200XL.
(Congo Bongo cartridge: 400, 800 and 800XL.)
†Atari 800, 600XL, 800XL and 1200XL.
**Also available for IBM PCjr.

All new games are scheduled to be in your stores for Christmas. Check your local dealer.

THE GENEALOGY OF BASIC

Chart By Russ Lockwood





Special Thanks To Those Who Remembered—RSL

PROFESSIONALS ARE MADE NOT BORN

HIGH SAT SCORES. GOING TO THE TOP COLLEGES. ATTAINING PROFESSIONAL STATUS. THESE ARE THE STEPS BY WHICH PROFESSIONALS ARE MADE. CLASS ACHIEVERS™ IS THE CRUCIAL EDUCATIONAL SOFTWARE TOOL YOUNG PEOPLE NEED TO MAKE THE FIRST STEP.

CLASS ACHIEVERS™ Preparing for the SAT is an interactive and intelligent software package which teaches study programs automatically. ***CLASS ACHIEVERS™ is the first educational software package to combine personalized learning methodologies with optimization theory.*** Like a school teacher, the program increases student's knowledge by creating a dynamic environment.

CLASS ACHIEVERS™ is designed to enhance the learning process at each step...First the student selects a complete SAT or specialized exam...then the student decides to take it in a practice or test mode. Students can request valuable hints for solving every problem and review both math and English principles.

A personalized profile is created after every exam. When the student returns, the program chooses the optimal questions needed to improve upon weak areas. These questions are different from the previous exam. In addition, CLASS ACHIEVERS™ randomly selects from the pool of 1000 questions. There are graphic solutions for geometry problems.

A team of experienced educators and educational software engineers designed CLASS ACHIEVERS™ for aspiring professionals.

It is available for under $100 and used with your Apple and IBM PC.

Contact Optimal Learning Corp. for more information or call

Optimal Learning Corporation
4701 Patrick Henry Drive #9
Santa Clara, CA 95054
(408) 980-0831

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CIRCLE 184 ON READER SERVICE CARD

DAVID H. AHL

QUIZ ????

If you have been a reader of *Creative Computing* for the past ten years and kept your eyes and ears open in the computing field, you should have no trouble with this quiz. (Well, not "no trouble," or it wouldn't be any fun.) **The answers are on page 306.**

1. The oldest microcomputing magazine that is still published today is
- **A.** Byte
- **B.** Creative Computing
- **C.** Dr. Dobb's Journal
- **D.** The Amateur Computer Group Newsletter

2. In 1975 and 1976, the editor-in-chief of *Creative Computing* was
- **A.** David H. Ahl
- **B.** Burchenal Green
- **C.** John Craig
- **D.** Stephen B. Gray

3. PLANIT is a software system for
- **A.** determining precise planetary positions at any point in time
- **B.** planning and forecasting
- **C.** authoring and dispensing CAI on any computer
- **D.** critical path scheduling

4. There is a well-known conjecture about producing a palindrome from any number. Which number in this list has failed to yield to the conjecture?
- **A.** 187
- **B.** 385
- **C.** 592
- **D.** 836

????

5. Blaise Pascal, the French mathematician, philosopher, and writer, devised a mechanized calculating machine when he was how old?
- **A.** 16
- **B.** 19
- **C.** 23
- **D.** 27

6. The Mark I was originally devised by Howard Aiken to
- **A.** perform additions and subtractions
- **B.** solve differential equations
- **C.** compute ballistic trajectories
- **D.** process census and statistical data

7. The first operational computer to use von Neumann's concepts of stored programs and data was the
- **A.** EDSAC at the University of Cambridge
- **B.** ENIAC at the University of Pennsylvania
- **C.** EDVAC at Aberdeen Proving Grounds
- **D.** Whirlwind I at MIT

8. On July 2, 1975, the price of a MITS assembled 1K static memory was:
- **A.** $97
- **B.** $139
- **C.** $176
- **D.** $209

9. The Scelbi-8H computer kit used which mpu?
- **A.** 8008
- **B.** 8080
- **C.** Z80
- **D.** 6800

10. The computer game, Wumpus, was written by
- **A.** David Ahl
- **B.** Bill Budge
- **C.** Bob Albrecht
- **D.** Gregory Yob

11. When the popular IBM 1401 computer was announced in 1959, the largest memory option available was
- **A.** 4K
- **B.** 16K
- **C.** 64K
- **D.** 256K

12. The company founded by Herman Hollerith eventually
- **A.** went bankrupt
- **B.** evolved into IBM
- **C.** merged with Remington Rand
- **D.** was taken over by the Census Bureau

13. Which one of the following is not a second generation computer?
- **A.** IBM 1401
- **B.** IBM 704
- **C.** CDC 3600
- **D.** RCA 301

14. Multivac was an early large-scale computer
- **A.** at Manchester University
- **B.** at the National Bureau of Standards
- **C.** at Aberdeen Proving Ground
- **D.** in an Isaac Asimov story

15. Flying Buffalo is
- **A.** a computer game
- **B.** a company that moderates play-by-mail games on a computer
- **C.** a database program for coin collectors
- **D.** none of the above

16. International Chess Master David Levy took on 12 computer programs simultaneously on October 19, 1975 at the ACM Conference. Two programs fought him to a draw. They were Chess 4.4 and
- **A.** Chaos
- **B.** Kaissa
- **C.** Belle
- **D.** Treefrog

17. Which of the following statements is not true about the Cromemco TV Dazzler?
- **A.** It produced a 128 x 128 element picture
- **B.** It required a minimum of 512 bytes of memory
- **C.** It was on a single S100 bus board
- **D.** Its kit price was $215 in 1976

????

18. The First World Altair Computer Convention
- **A.** was held at the Airport Marina Hotel in Albuquerque on March 26–28, 1976
- **B.** had on the program David Ahl, Carl Helmers, Lou Fields, and Ted Nelson
- **C.** had an attendance of around 700
- **D.** all of the above

19. Which of the following companies did not make a 6502-based system?
- **A.** The Digital Group
- **B.** Ohio Scientific
- **C.** Southwest Technical Products
- **D.** Electronic Tool Company

20. A beefed up Altair replacement power supply was made by
- **A.** IMSAI
- **B.** Tarbell Electronics
- **C.** Electronic Control Technology
- **D.** Parasitic Engineering

21. A computer introduced in late 1978 had text resolution of 30 lines of 64 characters. It was the
- **A.** Exidy Sorcerer
- **B.** Southwest Technical Products CT-64
- **C.** Smoke Signal Broadcasting Chieftain
- **D.** Compucolor II

22. Which of the following doesn't belong?
- **A.** KIM-1
- **B.** RCA Cosmac VIP
- **C.** OSI Challenger 1P
- **D.** Rockwell Aim

23. Which of the following is not true about Ithaca Audio?
- **A.** Made TRS-80 memory upgrade kits
- **B.** Became Ithaca Intersystems
- **C.** Was housed in a disco
- **D.** Made S-100 bus active terminators

24. The Micro-Engine is
- **A.** a single board computer
- **B.** Pascal on a chip
- **C.** made by Advanced Micro Devices
- **D.** an 8-bit microprocessor

25. The Pascal language was originally written
- **A.** at the University of California at San Diego
- **B.** in France
- **C.** by Niklaus Wirth
- **D.** in 1972

26. Which statement is not true about the National Educational Computing Conference?
- **A.** The first one was held in June 1979
- **B.** It was held in place of the CCUC conference
- **C.** It has strong focus on CAI
- **D.** It is sponsored by more than ten organizations

27. An interface/motherboard that made S-100 cards work with a Pet was
- **A.** made by Jade Computer Products
- **B.** called the Betsi
- **C.** made by CGRS Microtech
- **D.** constructed with just six chips

28. The predecessor to VisiCorp marketed all of these except
- **A.** Microchess
- **B.** The Electric Paintbrush
- **C.** Time Trek game
- **D.** Micro Information System

29. The first NCC to have a full day of sessions devoted to personal computing was in
- **A.** 1976
- **B.** 1977
- **C.** 1978
- **D.** 1979

30. Which statement is not true about WHATSIT?
- **A.** It means Wow, How'd All That Stuff Get In There?
- **B.** It was sold by Computer Headware
- **C.** It was written for the 8080
- **D.** It is a data base management system

31. Cybernetics, which is used in control theory, automation, and computer programming, was a word coined by
- **A.** B. Masterson
- **B.** S. Cruthers
- **C.** S. Morse
- **D.** N. Wiener

QUIZ

32. A government-financed machine was developed in conjunction with the Morse School of Electrical Engineering at the University of Pennsylvania. The co-inventors were
- **A.** Martin & Lewis
- **B.** Mauchley & Eckert
- **C.** Atansaoff & Berry
- **D.** Aiken & Wiener

33. With its 40 racks of equipment and 20,000 vacuum tubes, ENIAC ran up daily electric bills of
- **A.** 1 cent (during the war, electricity was free)
- **B.** $60
- **C.** $500
- **D.** $10,000

34. Jay W. Forrester, an electrical engineer and management expert who applied computer simulation to the real world, also
- **A.** Devised Cobol
- **B.** Retired on the proceeds at age 29
- **C.** Founded the RAND Corporation
- **D.** Invented random access memory cores

35. The earliest method of storing programs in a computer used tanks containing
- **A.** Mercury
- **B.** Water
- **C.** Chicken soup
- **D.** Liquid hydrogen

36. Dr. Grace Hopper was involved with which commercial effort?
- **A.** IBM 701
- **B.** Business programs for the Burroughs 7B
- **C.** UNIVAC
- **D.** HAL

37. The first programming language was developed in 1952 for UNIVAC I and was used for numeric and scientific applications. It was
- **A.** Fortran
- **B.** Short Code
- **C.** Macro Language
- **D.** Fuzz

38. The man who dreamed up the slogan "THINK" was
- **A.** A.A. Michaelson
- **B.** W.S. Burroughs
- **C.** T.J. Watson
- **D.** S. Craig

39. The largest Japanese electronics manufacturer is
- **A.** Fujitsu
- **B.** Hitachi
- **C.** Matsushita
- **D.** NEC

40. IBM introduced its personal computer in
- **A.** 1979
- **B.** 1980
- **C.** 1981
- **D.** 1982

41. Which of the following was the earliest word processing package?
- **A.** Word Master
- **B.** Word Star
- **C.** Electric Pencil
- **D.** Easy Writer

42. The first commercial computer kit was
- **A.** Altair 8800
- **B.** Scelbi-8H
- **C.** Sphere
- **D.** SWTPC 6800

43. The first issue of *Byte* was published by
- **A.** Carl Helmers
- **B.** David Bunnell
- **C.** Wayne Green
- **D.** Bill Gates

44. The first franchised Computerland store was opened in
- **A.** Santa Monica, CA
- **B.** Mountain View, CA
- **C.** Albuquerque, NM
- **D.** Morristown, NJ

45. The first notebook portable computer was
- **A.** Radio Shack Model 100
- **B.** Epson HX-20
- **C.** TI CC-40
- **D.** Workslate

????

46. The first product of Personal Software was
- **A.** VisiCalc
- **B.** Micro Chess
- **C.** Hammurabi
- **D.** Introductory Special (4 games)

47. The first joysticks for personal computers were made by
- **A.** Atari
- **B.** Cromemco
- **C.** MITS
- **D.** Wico

48. The Basic language was developed by Kemeny and Kurtz at
- **A.** Digital Equipment Corp.
- **B.** Hewlett Packard
- **C.** Dartmouth College
- **D.** General Electric

49. The first video game was
- **A.** Space Invaders by Masaya Nakamura
- **B.** Pong by Nolan Bushnell
- **C.** Catch It for the Odyssey I
- **D.** Tennis by Willie Higginbotham

50. Which of the following was the first to sell more than 1,000,000 computers?
- **A.** IBM
- **B.** DEC
- **C.** Commodore
- **D.** Sinclair

Reminiscence: Technology and Hardware

"Remember the good old days." Yes, there is nothing like time to soften the frustrations and amplify the joys of waiting 40 minutes for a paper tape to load or wiring your expensive, new microprocessor in backwards. In this section, nine writers share some of their joys and frustrations with us.

Taking us back the farthest is Steve Hunka who recalls the awe-inspiring Illiac I at the University of Illinois in 1952. Chris Rutkowski broadly takes us the next few steps from the 60's to the 70's and beyond.

For a more detailed glimpse at the formative days of the personal computing industry, no people were closer to it than our next group. Sharing their perspective with us are Chuck Peddle, designer of the Commodore Pet and Victor 9000; Paul Terrell, founder of the Byte Shops; Harry Garland, founder of Cromemco; Bob Marsh, founder of Processor Technology; Diane Asher-Leyland, one of the original '76ers; and Scott Adams, author of the first adventure games for microcomputers.

Wrapping up this section is David Lien who is just a bit amazed finally to have reliable hardware, but who wonders, "what comes next?" ■

FROM NUMBER CRUNCHING TO CREATIVITY/STEVE HUNKA

Steve Hunka is a professor at the University of Alberta in Canada, where he is the coordinator of a unit that supports educational research through the development of computer software in the statistical and computer-assisted instruction area. He first became involved with computers beginning with a Royal McBee LGP30 and Illiac I. He was also deeply involved in the PLATO project at the University of Illinois in the 1960's.

Using computers almost daily for 25 years provides a perspective not only for recalling the joys and frustrations of computing, but also for speculating about why computing is so important to so many individuals, and collectively to a nation.

Early computations using mechanical sorter-counters and punched cards provided for increased efficiency but left little room for creativity. Frequently, more time had to be devoted to card jams and replacing torn cards than to solving problems represented by the data. In the days of unit record equipment, read errors meant warped cards or cards with misaligned holes. Unit record equipment programmed through patch-boards by connecting input and output points with wiring pins frequently demanded more manual dexterity than creative thought and offered little more than the simplest arithmetic computations.

Twenty-five years ago, getting access to a computer with electronically stored program code was an exciting and awe inspiring event, because machines were large and had beautiful displays of blinking lights which announced each elementary operation. In 1952 the University of Illinois provided students and researchers access to such a computer through an ORDVAC-class of machine called Illiac I.

Illiac I

For the user, Illiac I consisted of two main units approximately twelve feet long, eight feet high, and three feet deep. One such unit contained the cpu, the other a 25K drum. Together these units occupied a room about 30 feet square; the power supply was in a separate 10'x15' room. An electrostatic memory of 1024 x 40 bits was provided by 40 small CRTs. On each tube was displayed a raster of 1024 dots providing an electrostatic delay circuit for 1024 bits. Execution speeds were relatively fast, e.g., 90 microseconds for addition and 800 microseconds for division. A flat screen CRT with a 35mm camera was also available for plotting purposes.

Most input and output was by paper tape prepared on teletype equipment. Special equipment for rapid duplication of paper tape was available. Students soon learned the frustrations associated with trying to unravel a "bird's nest" when a large roll of tape was accidentally dropped. Only the most elementary software was available for basic arithmetic functions and I/O. A machine language-like program code was used with two instructions per word.

Operating Illiac I was a model of simplicity. The operator could bootstrap the system by placing a read instruction into the instruction register by simply using the capacity effect of touching an external pin connected through a glass panel to each of 40 bit positions and moving one of three switches on a control panel only six inches spuare. A small speaker interfaced to the sign bit of one word provided an audible signal during computations. Operators soon learned to recognize endless loops even while engrossed in reading the latest novels. Time was precious on Illiac I. Three or four aborted jobs brought a warning note from the director of the center. Operational programs had to be documented and include an equation based on the execution times of each machine operation used and arguments representing data parameters. Today, many personal computers have as much power as Illiac I.

Many of the algorithms which were used in the early days of computing had been developed years before computers were available. Mathematical procedures which surely were considered impractical when derived, rapidly became basic components of a program library. Of particular importance were algorithms for solutions of simultaneous equations, approximations to trignometric and other functions, and finding eigenvalues and eigenvectors. The work of many mathematicians rapidly became available as part of a user's repertoire of computational skills. In a small way, the intellect and thought processes of previous generations became alive again. In a sense, a small portion of someone else's could be cloned through the computer.

A Cumulative Process

Perhaps one reason why the growth in computer hardware and software has been exponential is that each new system carries with it many successful ideas created by individuals in the past—computer Darwinism. The "computer tree," having in its main trunk such early computers as Mark I, Eniac, and Ferranti with numerous branches identifying other computer lines which have come and gone, graphically illustrates the richness and dynamic nature of the computer evolution.

Of course, not all extinct computing systems succumbed because of their design. The ability of the market place to absorb some systems was simply inadequate. A good example of this phenomenon was the demise of the IBM 1500 system, which was designed primarily for computer-based instruction and placed on the market in about 1965. This system, forgotten today even by most IBM personnel, was based on an 1130 cpu. The system drove up to 32 monochrome terminals with graphic capabilities, variable

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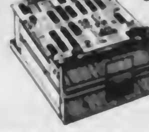

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character fonts, and light pen, as well as a 16mm static film projector and randomly accessible audio tape system. Some of its special features are still not available today in systems designed for instructional work. Such systems, when used with well designed and optimized instructional programs, in effect clone the art and science of an instructor. Clearly, computers are not restricted to perpetuating only the numerical components of man's intellect.

Today, instruction, music, art, the visual conceptualization of DNA and RNA, and yes, even fantasies can be passed on to others. Surely, with these capabilities the computer is not just another tool.

Some users of computers have their needs well satisfied by procedures defined by others. Others, who want to define their own procedures, find themselves forced to externalize their thoughts into program code, and making the program run correctly learn a great deal about the behavior of the process involved. Externalizing and examining one's thoughts about a problem is not a new procedure. Musical scores, the printed word, and algebraic notations are all examples of attempts to externalize what we think about. With computers we can frequently test the adequacy of our thoughts, reformulate and refine them, and test them over and over again.

Of course, not everyone will want to develop his own ideas for the solution of every task proposed for his computer. This would be a tedious and inefficient way to get things done. Nevertheless, each computer user in his own domain of expertise gains a wealth of understanding about a problem and the adequacies of his own thinking by seeking a computer solution.

Computers continue to be built in the likeness of man—cognitive man. Thus, computers should help us improve our thinking processes as we solve problems, including those problems associated with the design and manufacturer of more versatile machines.

Computing has come a long way since the days of Illiac I. Today, one can become creative much faster and easier than ever before. We can only hope that man's ability to think about and solve problems will increase at a rate commensurate with his most pressing problems. ■

THE COMPUTER AS A CREATIVE TOOL/ CHRIS RUTKOWSKI

Chris Rutkowski, president and research director of Rising Star Industries of Torrance, CA, created and designed the HASCI (Human Applications Standard Computer Interface) keyboard and Valdocs (Valuable Documents) software, key features of the Epson QX-10 system. Valdocs was the first truly integrated multimodule software system introduced for use on a micro computer.

He was formerly manager of market research and development for Epson America, marketing executive for Omnigistics, and operations manager/partner at Technical Design Labs.

Today, everybody knows that the computer is a tool. Right?

Well, ten years ago when *Creative Computing* was launched this truth was by no means self-evident.

Let me put this in perspective.

Computers were invented as servants of the biggest organizations ever conceived: the superpowers and the multinational corporations. These groups, not exactly known for their accurate vision of the future, supported and embraced the computer because of its prowess at one thing: number crunching. And between censuses and actuarial tables these groups had *lots* of numbers to crunch.

So specialized were the capabilities and so exorbitant the price of these earliest computers that some nameless sage at Univac predicted that the total world market for computers was five. How this number was arrived at remains unclear today, but the magnitude of his error was soon clear. Demand for computing power erupted upon the face of business with unprecedented rapidity. Seemingly overnight demand rose from none to too much—and created legends like IBM in the process.

Some nameless sage at Univac predicted that the total world market for computers was five.

But make no mistakes: computers were *very expensive*. So this newest survival tool was available only to those who could afford it. But not surprisingly, however, no company could afford to be without one.

The 60's

This created a market vacuum. By the 60's there were many thousands of companies that gazed longingly at the computers of their bigger brethren and wished that they too could gain control over their runaway paper mills. And this set the stage for the *mini computer revolution.*

It is important to note that the mini computer performed jobs that were different in no important way from those to which mainframes had been put before. They were servants to the power structure of corporations—tools, if you will, of organizations, by organizations, and for organizations. What had been created was a tool with no feelings, no conscience, no morals, no human flaws. In short, The Ultimate Bureaucrat.

Need an advance on wages? *Sorry, the computer only makes out checks biweekly.* A mistake in your billing? *Computers don't make mistakes; only humans make mistakes.* Not feeling up to snuff? *Your keystroke count is down, Miss Jones. . . .* And so on.

True, the computer gave management the most accurate and up to the minute control of organization ever achieved. But it also dehumanized the contemporary office and gave rise to a new disease: *Cyberphobia.*

The 70's

By the 70's, the spurt of semiconductor technology precipitated by the space program made possible something called LSI; Large Scale Integration. LSI made possible semi-

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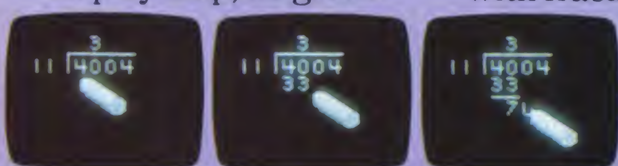

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Actual photographs from Commodore 64.

conductor devices of unheard of complexity which could even be made to resemble large computers in their architecture. Various companies toyed with programmable logic devices for such exotic applications as traffic light control.

It was at this time, when LSI technology was emerging and productivity was sagging in spite of advanced data processing, that the personal computer was born.

The personal computer was a radical departure from the data processing models that had so-long served corporations. Data processing computers were enormously de-humanizing. They were, perhaps, the culmination of second wave industrial society's belief that the individual was without worth. Personal computers, served the needs of individual human beings and were by definition *humanizing*.

The personal computer was, thus, the result of an available technology being used in a way totally unpredicted by the mainstream corporation which had given birth to the technology. That is, it was the result of *Creativity.* And *Creative Computing* was right there from the beginning, passing the word among a hardy band of renegades—reinforcing the belief that computers could be more than just number crunchers.

And because of that, today you have Macintosh and Valdocs and personal productivity software and all the other things that seem so self-evident and obvious.

Happy Birthday *Creative Computing.* And thanks. ■

COUNTERCULTURE TO MADISON AVENUE/ CHUCK PEDDLE

Chuck Peddle, founder, president, and CEO of Victor Technologies, created the Pet—the first mass market oriented personal computer–for Commodore Inc. In 1980, he started Sirius Systems Technology, Inc., producing the Sirius I, a 16-bit microcomputer that is currently the most popular microcomputer in Europe. In the U.S., it is marketed under the trade name Victor 9000. Peddle was also involved with the creation of MOS Technology's 6502, 6800, and 6507 microprocessor chips.

The following is excerpted from a speech delivered by Chuck Peddle at Sybex Pioneer Days in June 1984.

I believe that marketing is the key to the personal computer industry—its biggest opportunity and its biggest problem. Marketing is what this industry is all about.

To understand those statements, let's take a look back. The first question we need to ask is "Why do people buy computers?" The need for computers is predictable. Once you are attracted to computers, once you are computer literate, you ask yourself what happens when you become computer-deprived. My belief is that the industry began when people realized that they were computer-deprived and wanted to satisfy this new need. I think the need for computers is relatively strong, and I believe that the marketers of the industry capitalized on this need.

I believe that the industry really started with the Dartmouth Basic system. That was probably the first time that a relatively low cost computer—in those days a "relatively low cost computer" was several hundred thousand dollars—was made available on an "on demand" basis to a large group of people. The Basic in the operating system allowed the student to be trained without listening to one lecture. He would sit down at the Teletype and he would learn how to program using only the Basic instruction manual.

The experiment was so successful that timesharing became immensely popular at universities across the country. Soon this popularity spread to business, and the availability of inexpensive machine time allowed a great many people to become computer literate.

Pet assembly line at Commodore, Santa Clara, CA, March 1980.

Technology

As timesharing became a way of life for both business and academic users, three things happened to turn the tide of computer events. In 1973-74 the first microprocessors were announced and threatened the livelihood of electrical engineers everywhere. Prior to 1973, an engineer could spend a whole month designing a single circuit; if he was really good, he could stretch out a small control design for a year. And no one could design it better than he could, so he had a career.

Marketing

But with a microprocessor and two or three other control chips, he could sit down and hack out a design in an afternoon. Almost overnight a need (and hence, a market) for microprocessor literates sprang up, and engineers scrambled to find out what this infant industry was all about.

The KIM-1, the Altair, and various devices from Digital Group were among the products aimed at this market—the market of technicians and engineers who wanted to work on computers.

In 1975 we saw another landmark event: the opening of the first computer store—a store that sold products that people didn't understand but knew they had to have. The half dozen or so stores that opened that year sold only one product really; they sold computer expertise—the knowledge needed to build a computer. And the salespeople were also good at helping you to debug the products they sold.

Also important in the retail scheme of things was the rise of Radio Shack. Radio Shack dominated the retail distribution of electronic devices and parts; all they needed was a computer product. The original intention of the folks in Fort Worth was to sell a computer for $300. The independent computer stores, they figured, would not be able to make a profit on a $300 machine and would soon go out of business as they tried to meet the competition. As it turned out, Radio Shack wasn't able to make a profit on a $300 machine either, and the original TRS-80 Model I was introduced at $600.

By 1978 we had set the stage. We had created the market, the new breed of computer literates; the technology; and the distribution channel. We had begun to satisfy the need of the market for personal computing.

What happened in 1978 was, perhaps, even more significant. That was the year that Steve Wozniak got fed up with waiting for programs to load into his 16K Apple from a cassette recorder. That was the year he introduced the first low cost floppy disk drive, an event that was to change the character of the market.

The next truly significant event occurred about a year later: *VisiCalc* was introduced by Dan Bricklin and Bob Frankston of Software Arts. *VisiCalc* was, in my opinion, the first commercial program that was written for the personal computer. It proved that with two disk drives and 48K of memory you could solve real world business problems—and solve them in a way that timesharing systems couldn't. It was a product created especially for this new market.

The point I want to make is that from 1976 to 1978 we were solving the problem of selling computers to people who *wanted* computers; we were satisfying the home market. In 1979, with the introduction of *VisiCalc*, we began to sell computers to people who *needed* computers; we saw the beginning of the business market.

Two Computers Per Desk

The business computer market is very interesting. It is a market that will continue to consume computers up to and including more than one computer per desk. My personal belief is that businesses will buy computers until there are two per desk; if you really use the computer in the office and you believe in my theory of computer need, you will not be able to work at home without a computer. Businesses will be forced to supply second computers to their managers for home use.

The transportables are a signal to the marketplace. Certainly, notebook portables are a signal to the marketplace. The main problem with portables today is that they are not as powerful as the machines we keep on our desks.

As the machines on our desks become more database oriented, we will have to find a way to give computers at home the ability to access the same data we can get with our office computers. That will become an entirely new specialized market.

In 1980 we saw yet another landmark invention: Clive Sinclair's disposable computer. Many people bought Clive's machine, and as soon as they became computer literate, many realized that the machine was inadequate. But by that time they were computer literate enough to justify the expense of a more powerful computer. The Sinclair computers fed the market in a completely new way.

More Marketing

With the advent of the Sinclair computers and the Commodore Vic 20, we established a second, even more important, distribution channel. As the retail channel expanded to include K Mart and Toys-R-Us, the sale of computers reverted to the state in which we saw it back in 1976; computers were being purchased to satisfy the need for computer literacy. Now there were two ways to market a computer: through the computer dealer and through the mass merchandiser.

The problem that the industry faces today is still marketing oriented. The cost of getting a product to the marketplace is so high that there can be no more small entrepreneurial successes like *VisiCalc*. The cost of bringing a good software package to market these days is in the neighborhood of $5 million.

If we want to allow the industry to grow as it has in the past, we must create another step. We must allow the market to look at a product and decide "yes, that's what we really want," rather than letting the winners be chosen on the basis of packaging and promotion.

Today we face an industry that has evolved from a counterculture approach to a Madison Avenue approach. We see a market that may have outgrown its ability to create truly worthwhile products. Until we find a solution to this problem, I predict that the industry will stagnate. ■

A GUIDED TOUR OF PERSONAL COMPUTING/ PAUL TERRELL

Computer power was meant for the people. In the early 70's computer cults were being formed across the country. Sol Libes on the East Coast and Gordon French in the West were organizing computer enthusiasts into clubs. My own fraternity was the Homebrew Computer Club, which met in Palo Alto, CA, once a month and numbered among its members such notables as Jobs and Woz of the yet to be named Apple Computer Company, Garland and Melen of Cromemco, Ed Faber of Imsai (now of ComputerLand), and many, many more.

My passion was retail, and the prospect of providing a storefront for the host of products that would spew forth from that membership was overwhelming—as was the idea of being the first electronic candy store in Silicon Valley.

The first Byte Shop opened its doors on December 8, 1975 (my birthday), and within its walls Apple Computer was birthed with a purchase order for 50 Apple I computers that

WHAT A FLOOD IN OKLAHOMA TAUGHT US ABOUT RUGGED PERSONAL PRINTERS.

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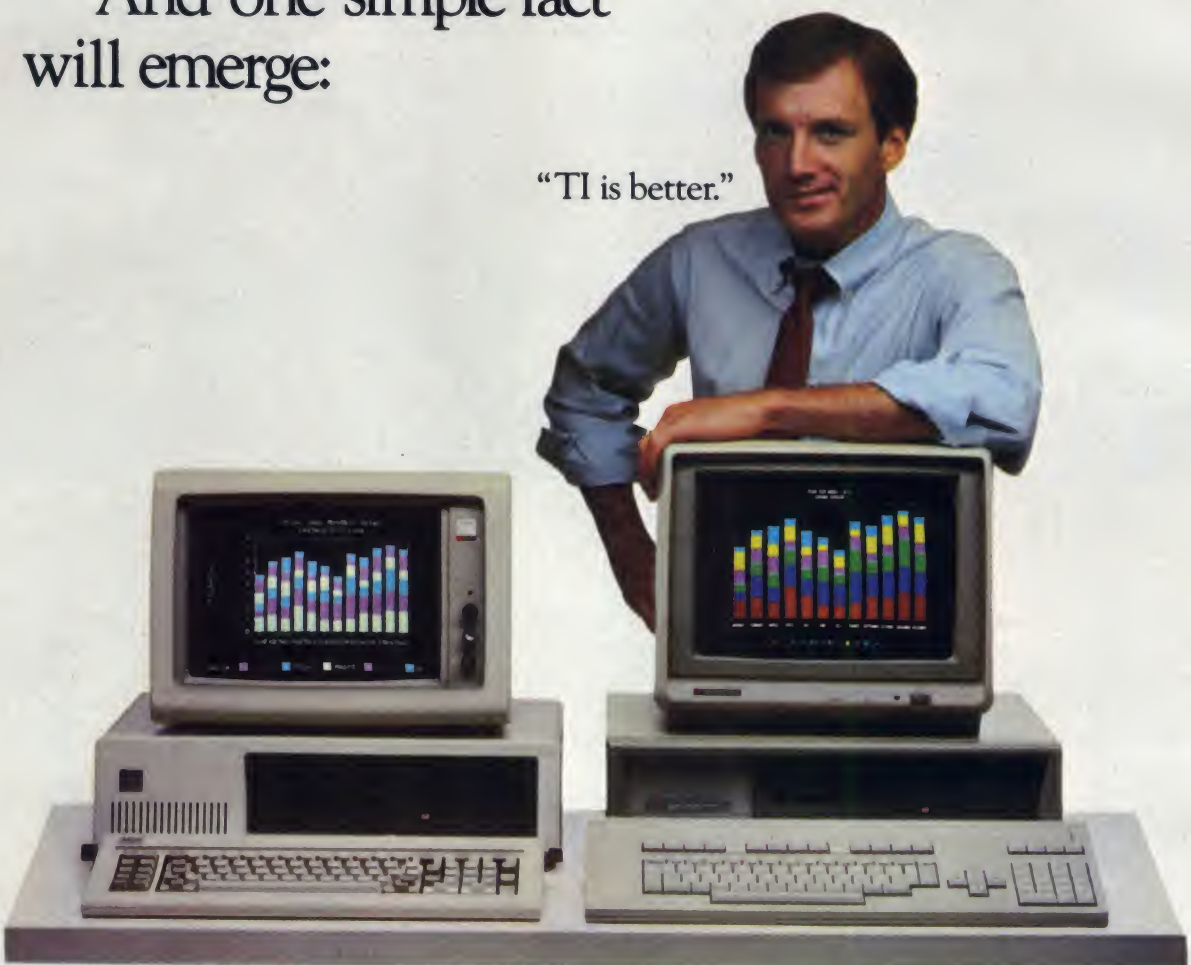

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Paul Terrell started the first chain of computer stores, the Byte Shops in 1975; he made computer magic in 1978 with his Exidy Sorcerer computer, created a software fantasy land in the Software Emporium in 1981, and established Romox for the electronic distribution of software in 1982.

Steve Jobs leveraged into the seed capital to start his company.

We also taught Ziff-Davis Publishing Company a thing or two about publishing as we negotiated to buy every back issue of *Popular Electronics* because old issues were selling as collectors' items.

While all this was going on, the voice of IBM was asserting that computers could not be sold in retail stores. Today their stores are called Product Centers and Byte Shops are no longer hobby shops but business computing centers.

The kids that grew up in our stores became entrepreneurs rather than hobbyists. Steve Leininger left the Byte Shop of Santa Clara to design the TRS-80 for Radio Shack in Fort Worth where he still leads their design team. I am also certain that somewhere in the infamous past of Chuck Peddle, creator of the Pet, a Byte Shop touched his soul. But with 74 Byte Shops nationwide, it was time to move on and create the computer of my retail dreams.

The Magic of Sorcerer

In April of 1978 my Sorcerer Computer was introduced at the Long Beach Computer Show. My goal was to bring computer magic to the people. Computers were the most misunderstood creatures in the world, and if everyday people were to appreciate and use them, the mystique and magic had to be dispelled.

Graphics would play a major role in getting the computer into the home, but graphics must be as easy to put on the screen as text. The graphic resolution of the Sorcerer was better than that of Apple, Commodore, and Radio Shack combined. The Sorcerer had the first programmable keyboard on the market; any key could be programmed to evoke any special character or function. It was also the first personal computer to offer software on ROM cartridges.

How could anything with standard software like Microsoft Basic and CP/M, the most advanced microprocessor chip, 64 x 30 line display, and 64K memory sell for $895. Ten thousand computers later I learned that people who walk around with arrows in their backs are called pioneers. Today almost every home computer has cartridge software capability, and computer graphics in the form of video games has made computers at home in our homes. Most of the other features of my dream machine are, today, standard equipment with one exception—price. Let's toast the pioneers who left the market clipping coupons at $895 before the price war of 1983.

Software to the People

If you have doubts, take the word of this visionary: software will be in the 80's what hardware was to the 70's. It was with that in mind in 1981 that I conceived the Software Emporium chain to be to the personal computer industry what the record store is to the music business.

The first Byte Shop opened its doors on December 8, 1975.

Believing that the software business is like the record business, which is to say hit or miss, I soon discovered its pitfalls. After all, pioneers are also explorers. My initial stocking inventory of 650 stock keeping units (SKUs) showed up COD from Softsel. You can always tell what stage of development an industry is in by the payment terms offered by its businesses, and software was obviously in its infancy because the retailer was forced to play bank.

To add insult to injury, by the time the product got to my shelf, everyone in the chain of distribution had added on his profit. There the product sat—on my shelf being financed by me and my bank—waiting for a buyer to come along. Having 20/20 hindsight developed in my previous ventures, I quickly realized that this was not a healthy situation and that if Software Emporiums were to flourish I would have to come up with a new approach. I did—consignment inventory.

But that turned out not to be the answer either; consignment only transferred the inventory carrying costs up the channel of distribution.

The Home Stretch

I continued to ask myself how software products could be put into retail stores without anyone in the distribution channel having to bear the inventory carrying costs. The answer is electronically, and I am off on my fourth and final venture in personal computing, Romox, Inc.

The goal of Romox is to remove the burden of inventory carrying costs of software along with the risk associated with buying product that may not sell through to the consumer.

It is important if you are going to be successful in an endeavor not to be too revolutionary in an evolutionary world. People resist change, and if the mission is to move mountains, they must be convinced that those mountains are only mole hills. Romox is not designed to change existing channels of software distribution. Romox is intended to make software a more profitable business by offering the benefits of electronic distribution to everyone involved in the sale of software—consumer, retailer, distributor, publisher, and author.

The consumer can buy software at a reasonable price. The retailer can carry every title in every format since there is no inventory carrying cost associated with programs in electronic form (When the program is copied

onto cartridge or disk from the programming terminal it is then, when the product is created and paid for, that money becomes due). The distributor experiences an increase in blank media sales with no risk of obsolescence since many different titles can be programmed onto the medium by the customer. The publisher gets his product to the retail shelf immediately without any inventory exposure, and finally, the author receives a larger royalty check because distribution is efficient and volume is high because price is reasonable.

I see electronic distribution as a perfect solution for a not so perfect industry that saw two billion dollars in losses among major manufacturers in 1983 alone. Personal computing is an equal opportunity industry—big companies fail right along with the little guys.

Home Delivery

Romox, with its programmable cartridge media and point of sale manufacturing machines, has provided to the industry the next logical step in software distribution. What about the future? Is home delivery of software the follow-on to Romox?

Certainly at some point in our future we will experience the true meaning of computers in our homes. They will have a value way beyond video games and will be connected to vast networks that will offer access to databases that we have not yet begun to create.

The future of home delivery of software is as vague as that statement. With Playcable a failure in Los Angeles and Warner Communications pulling the plug on Qube in Columbus after eight years of less than successful operation, how can companies like Coleco/AT&T and Atari/Activision justify throwing good money after bad. The message to be learned from these failures is, "The customer doesn't care for or want home delivery of anything." Or, put another way, people eat out and people eat at home. When they discover how to use the stove, they will eat at home more often. Until then, let's dine out with Romox and retailers.

Personal computing has come a long way in ten years, and we have barely scratched the surface. Computers are as significant and as exciting as the automobile and the telephone. The opportunities are yours and the time is now.

"There is a tide in the affairs of men which, taken at the flood, leads on to fortune."—William Shakespeare ■

TEN YEARS AND COUNTING/ HARRY GARLAND

Harry Garland received his B.A. degree from Kalamazoo College and his doctorate from Stanford University. Garland was assistant chairman of the Department of Electrical Engineering at Stanford before founding Cromemco in 1975. He has served as president of Cromemco since its founding and takes pride in the fact that Cromemco has an unbroken ten-year record of technical innovation, sales growth, and profitability.

When Roger Melen and I started Cromemco, the largest memory chip had 1024 bits of storage, Ed Roberts was trying to name a new computer kit that he had developed, Federico Faggin had left Intel to design a high-performance successor to the 8080 microprocessor, and no one knew that the computer revolution was about to unfold.

It was in the cramped editorial offices of *Popular Electronics* magazine, high above the noisy streets of New York City that Roger Melen first saw a prototype of Ed Roberts's computer.

> *Nowhere was this cooperation more evident than in the computer clubs that spontaneously appeared throughout the country.*

Les Solomon, the indomitable technical editor of *Popular Electronics*, was explaining to Roger how the Cromemco Cyclops camera, scheduled to appear in a future issue, would be an exciting peripheral for what was to be called the Altair computer. Les, as usual, was right, and the Cyclops became the first of many add-on products for what was to become the first of many S-100 bus computers.

The Second Peripheral

But few people knew how to use these new computers. These individuals with the vision to see the potential of microcomputers thirsted for more information on how these computers could be used. Subscriptions to *Creative Computing* (which was still being printed on newsprint stock) skyrocketed and new magazines like *Byte* and *Interface Age* appeared. A book on microprocessors, written by a British chemical engineer named Adam Osborne, became an overnight best seller. Free communication of ideas was a hallmark of those early days as manufacturers, editors, authors, and computer users worked together cooperatively to build an industry.

Nowhere was this cooperation more evident than in the computer clubs that spontaneously appeared throughout the country. The Homebrew Computer Club in California was one of these. It was here that Steve Dompier demonstrated the first application program for the Altair computer (loaded from the front-panel switches it would play a tune on a nearby AM radio).

Bob Marsh used this forum to announce that his company (Processor

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CIRCLE 196 ON READER SERVICE CARD

Technology) would produce a 4K memory board for the Altair. The first microcomputer color graphics board, the Cromemco Dazzler, also premiered at the Homebrew Club. And club members Steve Jobs and Steve Wozniak demonstrated a single-board computer with the unlikely name of "Apple."

As applications for these new computers developed, users were looking for more and more performance and features. When Federico Faggin's company (Zilog) introduced the Z80 processor, Cromemco was the first computer manufacturer to adopt this processor. The 4MHz ZPU card, as it was called, is still one of Cromemco's best selling cards and remained the performance champion on the S-100 bus until the Cromemco 8MHz 68000/Z80 DPU card was introduced recently.

As processors became more powerful, memory chips became more dense. The 4K memory card that Bob Marsh produced was exciting in its time because the original Altair computer came standard with *just 256 bytes* of memory. To appreciate the progress that has been made, consider that this year Cromemco introduced an S-100 RAM card (called the 2048 MSU) that has a whopping *2 megabytes* of memory.

The rate of technological progress we have seen over the past few years is not slowing down at all.

Continued Progress

Amazingly, the rate of technological progress we have seen over the past few years is not slowing down at all. Microprocessors are becoming faster yet. Eight-bit processors gave way to 16-bit processors which are now yielding to 32-bit processors. And while the memory chips used in the Altair computer held 1024 bits of data, the chips now being used by Cromemco and other manufacturers hold 262,144 bits. At the current rate, memory chips containing more than *one million bits* of data will be in use within the next three years.

No one would now deny that the last ten years have marked a revolution in the computer industry. But it is just a beginning. There is today an enormous gap between what computers could do and the software available to do it. Cromemco, for example, recently introduced a full-resolution TV camera interface for its line of 68000-based computers. The possibilities of a moderately priced computer that can see with full TV resolution are mind-boggling. Add to that multi-megabyte storage, pattern-recognition software, and robotic manipulation and you have the stuff of which the future is made.

Since Cromemco is the oldest surviving microcomputer manufacturer I am sometimes asked what it is like to have participated in the fastest-growing period in the history of computing. My answer is that I don't know, because the fastest growing period in the history of computing is yet to come. ■

1975: ANCIENT HISTORY/ ROBERT MARSH

Robert Marsh, who has a B.A. in Biological Sciences from the University of California at Berkeley, worked for several years in hi-fi and as an office equipment design engineer before founding Processor Technology Corp. in 1975. He was vice president and later president of PTC until it went out of business in 1979.

Since then, he has been a computer design consultant, and about 100,000 units of his designs have been produced, including the Sol 20, one of the first personal computers. He is now CEO of Drive C, an Emeryville, CA-based firm that makes RAM disk emulators for personal computers. Married, he has two sons, ages 10 and 14, who enjoy personal computing and backpacking in the Sierras.

It has been one amazing decade for us personal computer fans! Today there are millions of computers in homes and businesses around the world, but 10 years ago things were different.

The first home-built computer kit, the Mark 8, came out in 1974. This little machine used an 8088 plus about 50 other chips. You had to build it completely from scratch—there was no power supply, no CRT screen, no keyboard, no case. There wasn't even any software. When you tried to use a Mark 8 you felt you had all the technical sophistication of a caveman holding the first fire-hardened spear. Since only a few Mark 8s were ever finished, I think of 1974 as part of the pre-historic era. History began in 1975. What was it like back then?

First of all, nobody owned a personal computer then. We called them "hobby computers," believe it or not. This term was to stick to our machines for almost two years and was to become a major handicap for those of us who wanted to use our computers for business purposes. Many of us called them microcomputers or small computers.

Later on that year, Ted Nelson (if you haven't read his classic book, *Computer Lib*, you should) came up with my favorite name, dinky computers. Portia Isaacson didn't come to our rescue by coining the term personal computer for another year or so.

I have seen ads in the *Wall Street Journal* and elsewhere in which Apple Computer Corp. claims Wozniak and Jobs invented the personal computer, but Steve and Steve waited until 1977 to invent the Apple II. By then tens of thousands of Altairs, Imsai 8080s, Cromemco Z-1/Z-2s, and Processor

What made over 100,000 Apple II owners fall in love with System Saver?

It's the most versatile, most convenient, most useful peripheral ever made for the Apple.*

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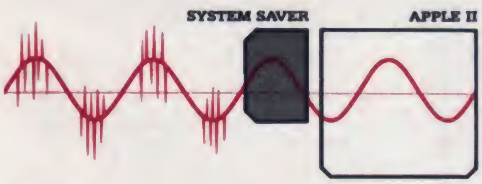
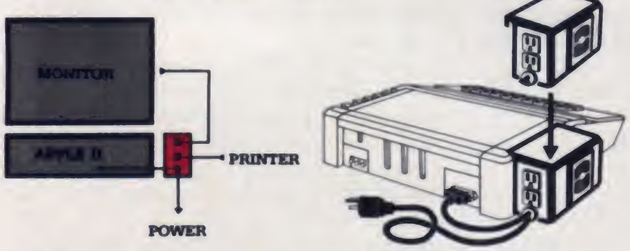


System Saver makes your Apple more convenient to use.
No more reaching around to the back of your Apple to turn it on. No more fumbling for outlets and cords to plug in your monitor and printer. System Saver organizes all your power needs.



It functions as a multi-outlet power strip with two switched outlets. Plus System Saver offers the ultimate convenience; a front mounted power switch for fingertip control of your entire system.

System Saver lets your Apple keep its cool.
Today's advanced peripheral cards generate heat. In addition, the cards block any natural air flow through the Apple IIe creating high temperature conditions that shorten the life of the Apple and peripheral cards.

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CIRCLE 131 ON READER SERVICE CARD

Technology Sol 20s had already been sold by computer stores around the world.

Today, who can even guess how many different personal computers are available? Back in '75, we didn't have to spend much time deciding between brands; there was just one. MITS in

During rapid expansion phase, some offices of Processor Technology were set up in house trailers pulled into a warehouse; May 1977.

Albuquerque, NM made the Altair 8800, and if you wanted your own computer, that's what you got. Early in the year you could get one of these machines for only $400 in kit form.

Three to six months after sending in your hard earned cash, you got:

- A nice blue box with four card slots, a power supply, and a binary front panel complete with lots of toggle switches and red LEDs.
- A CPU board with an 8080 microprocessor chip.
- 256 bytes of RAM (that's right, 256 bytes, not K-bytes)
- No ROM at all
- No interfaces to the outside world at all.
- No software at all.
- Assembly instructions and schematic diagrams.
- Lots of solder.

A really sophisticated (and well-heeled) buyer might get up to 16K bytes of RAM for an additional $1000 or an RS-232 interface for $120. Basic was an extra $150.

You had to put it together yourself. MITS advertised them assembled and tested but those units took even longer to get. For an old-time electronics hardware guy like me it was fun and challenging to put one together, but for some others, well . . . have you ever watched a Cobol programmer try to figure out which end of a soldering iron to pick up?

Can you imagine what it was like to finish building the very first dinky computer on your block, maybe the only one in the state? Yes, it was quite a feeling. But as soon as you finished building and testing your computer, you were forced to confront the awesome truth. You had to start programming. That meant setting in a program in binary, one bit at a time, switch by switch. Real binary virtuosos could key in the bootstrap loader for MITS Basic in about three minutes. But even Steve occasionally made mistakes and would have to start over, back to bit zero.

After keying in the loader you had to wait 40 minutes while your teletype loaded Basic. Almost no one had a CRT terminal then. We usually needed ASR33 teletypes with paper tape readers attached. If you are lucky, you have never used paper tape. Back then you were very lucky to get an ASR33 for less than $1000. (Only a few years later I tried to give away a portable version of this teletype at a Home Brew Computer Club meeting and no one would take it). These entirely mechanical monsters generated quite a few bit errors even at 110 baud. Often, about three quarters of the way through loading Basic, you got an error. Then you started over again.

Many times did I dream of a replacement for paper tape, but floppy disk drive systems for microcomputers hadn't been invented yet. There was no CP/M and, of course, no PC-DOS. No one had even dreamed of owning a hard disk. In 1975 the state of the art for program storage and loading was 1200 baud on audio cassette tape.

Can you imagine what an advance cassettes were over paper tape? Cassettes were ten times faster and, though far from perfect, lots more reliable. Imagine the thrill of waiting only four minutes to load Basic.

If you wanted to program your machine, you had a choice between binary machine code and Basic. Hardly anyone had an assembler for the 8080. Most people did have the 4K, 8K, or 12K versions of Basic written by college dropout Bill Gates and Paul Allen (later founders of Microsoft).

Many Altair owners had never heard of Pascal, C, or PL/I, and anyway no versions of these languages existed for the 8080 chip. What if you wanted to balance your checkbook with your computer? You wrote your own program in Basic. What about word processing? You would have had to dream about it for two more years until *Electric Pencil* came out. *WordStar* came even later. Data base? Spread sheet? Not for three more years.

If you were able to get your machine up and running and actually did some programming in Basic, you were probably the *de facto* hobby computer expert in your area. What did you do if you needed help? Remember, the computer store wasn't invented until 1976. You spent lots of money (and lots of time on "hold") for phone calls to Albuquerque. Or you joined a local computer club or formed your own club. Overnight, computer clubs sprang up just about everywhere so people could get together to learn from each other how to build and use hobby computers.

> *If you were able to get your machine up and running and actually did some programming in Basic, you were probably the de facto hobby computer expert in your area.*

Today, every newsstand in the country has several computer magazines, and the racks in computer stores can barely carry the load. In 1975 there were only four magazines with any content on hobby computers: *Byte, Creative Computing, Popular Electronics,* and *Radio Electronics.* We needed to read every word in every advertisement and article about computers. Today you probably couldn't find enough time in a month to read just the lead articles in every personal computer magazine.

We didn't have many things you take for granted today, but we did have a feeling of excitement and adventure. A feeling that we were the pioneers in a new era in which small computers would free everyone from much of the drudgery of everyday life. A feeling that we were secretly taking control of information and power jealously guarded by the Fortune 500 owners of multi-million dollar IBM mainframes. A feeling that the world would never be the same once "hobby computers" really caught on. ■

AS WE WERE/ DIANE ASHER LEYLAND

When consumers complain about the unfriendly nature of current computer technology I have to smile. My mind drifts back in time to the "old days" which is to say to less than a decade ago.

In the old days, your computer arrived in 157 pieces, and if you were lucky, the assembly instruction manual came three weeks later. Most of my customers had the computer assembled by then and were calling with more questions. These questions were never easy. Anyone who could figure out how to assemble a computer had already mastered the simple stuff. They were hungry for more memory (not happy with 4K?). They needed information on how to address that memory (See the bank of switches on the board?) and how to attach the computer to a printer (Send $700 and I'll send you an interface).

Marketing

In the old days, computer companies were different. They were small, and most of them were in business to have a good time. Webster, founder of Company X, had designed the very latest in whizzo bango technology, and the company was sure to make billions. I spent two years telling customers that their disk drives would be available in two weeks. The customers were remarkably patient. After they determined that there really was no way I could ship the product, some called just to hear me say "two weeks." It got to be a standard. Any product would be available two weeks from any given date.

Things were different for the magazines back then. Writers frequently received incomplete or unassembled products to review. Technical articles were incomprehensible. Advertising was technical. Companies would run their spec sheets as advertising. There was little competition for the advertising dollar. Both industry publications carried everyone's advertising.

In the old days, there was less money in the industry, but it was spent in a more creative manner. While money was spent on advertising, the best promoters were the users of the product. The budget often included a trip to a user's group somewhere to show the product and collect more orders. Under intense questioning (whaddya working on?) the representative from the manufacture might let something slip about a new product.

The airlines had plenty of flights, but they often assumed you were a drug smuggler when you begged baggage security not to x-ray your diskettes.

Nothing was as much fun as talking to the customers about what they were doing with Whizzo Bango. That way you could figure out how to market the product.

The usual method of marketing a product was to talk to a users group about the product and let word of mouth take over from there. For faster exposure you could place an ad in either national computer publication and wait for the orders to roll in. The fastest way to market a product was to swear everyone to secrecy, let them in on a secret, and wait for the dollars to roll in. Checks arrived daily in the mail for products which might not yet exist. If you insisted on ordering it, you might be able to convince him to take your money. There seemed to be an endless supply of money to be spent on computers. It was more expensive than keeping a race horse.

People bought every new device that came out for their computer. And it wasn't cheap. Most interface cards cost over $700, and that didn't include the price of the device to which it was being connected. Yet anyone who released a product had more than enough customers. Expenses were low, how much did it cost to keep a company in your garage?

The old days were filled with characters. You had to be, what my grandma called, one brick short of a load to be involved in an industry which was changing, complicated, and expensive. The people involved were people with vision, people who stubbornly clung to the idea that computers could offer individuals advantages previously available only to large corporations. They married their jobs, considered products their children, and would eat, breathe and dream their work. They were all entrepreneurs, people who had left respectable jobs to involve themselves in an industry of a somewhat questionable nature.

Two fairgoers play with an early computer game at the First West Coast Computer Faire, April 1977.

Product Development

The old days also offered thousands of dollars of undelivered products. In all fairness, there was usually no intention to defraud. It worked something like this. Engineer says to marketer "Hey, we've just figured out how to make the Whizzo Bango communicate with a disk drive. Why don't we sell those." The advertising department asks "How long will it take to make that available to our customers?" "Not more than a month" replies the hopelessly optimistic engineer. "Okay, well the magazines have a three-month lead time, so I guess I'll place the ad right away," says the hopelessly naive advertising department. And off to *Creative Computing* go the artwork, the instructions, and the check.

Hopelessly optimistic engineer is then stunned to discover that the chip needed for the disk system is no longer available, the plastics manufacturer has a four-month lead time, and the drive manufacturer hasn't quite finished the technology needed to make the drive faster than a tape reader.

"Oh well," says the CEO, "we'll see how many people send money. If enough people send money, we'll offer the product."

Everyone was always instructed to return money to customers who became impatient for their devices, but no one wanted his money back. They wanted their equipment. Some of them waited years for a delivery. After a while we begged them to take their money back, but they wanted none of that. They wanted the product.

Shows

Computer shows were different then, too. There were plenty of hotel rooms to accommodate a convention of 13,000 people. Traveling there was a breeze. The airlines had plenty of flights, but they often assumed you were a drug smuggler when you begged baggage security not to x-ray your diskettes. Booths were filled with innovative products. Everything was new. It was the debut of the microcomputer-based word processor, game, and finally—the spreadsheet. Everyone wore jeans to shows. Jim Warren also wore roller skates to his shows. Computer shows also gave people a place to do what came naturally—to party.

We have always been an industry that loves to party. Anywhere more than three people gathered was a party. Parties were a great place to gossip. It

> *In the old days, you had a complete collection of software if you had a Basic, an assembler, and the game of Life.*

was an industry that lived on gossip. Advances occurred too quickly for any other media to assimilate. Competitors gossipped—about each other and to each other. They swapped ideas, bragged about future products, and debated the future of the industry.

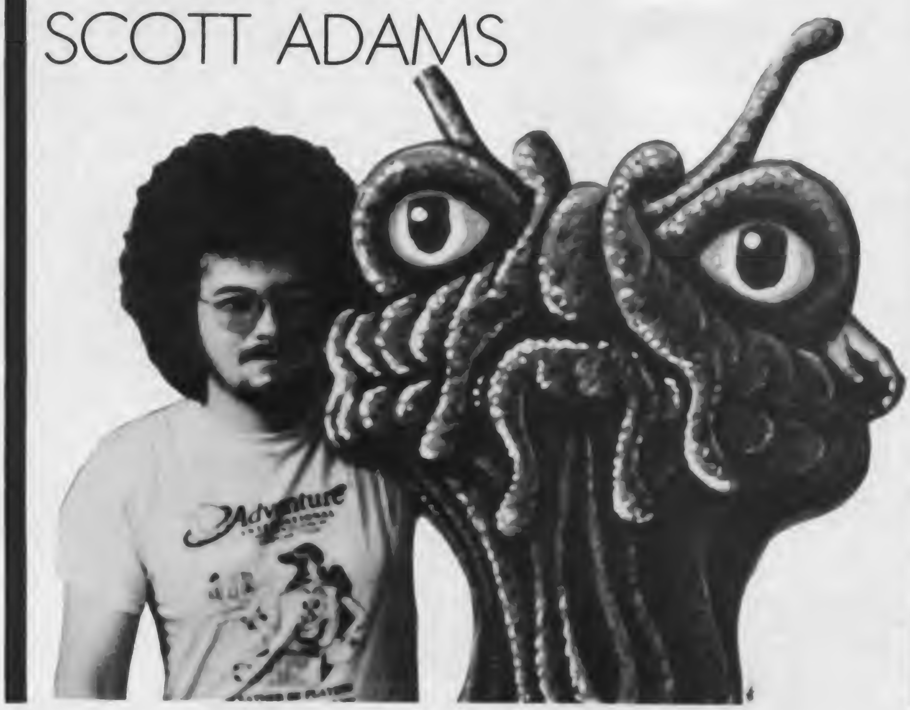
It was a time of opportunity. Everyone started on an equal footing—Ph.D. and high school dropout worked together. Technological advances moved faster than the school system could teach, so everyone learned as the action unfolded. All you needed was a quick mind. It helped if you had a sense of humor.

Software

In the old days, you had a complete collection of software if you had a Basic, an assembler, and the game of Life. Forget canned programs, you had to use a toggle switch to get your program in. Things went uphill when keyboard input became available, and you could enter your programs letter by letter. Luckily there wasn't too much typing you could do before filling all 4K.

So the next time you are cussing at the manual, congratulate yourself. Riding the leading edge of technology is never safe, let alone easy. It is probably precious little comfort to you, but the hardware and the software have actually become more friendly, your system didn't cost you an arm and leg, and you didn't have to assemble it yourself. If you want more than that, you are just plain greedy. ■

ADVENTURES IN PERSONAL COMPUTING/ SCOTT ADAMS



Scott Adams, 32, is the founder and president of one of the oldest microcomputer software houses, Adventure International. He is the author of the original adventure game played on the microcomputer, Adventureland.

He lives in Longwood, FL with his wife Alexis, who is also very active in their business, and their three children. He has a B.S. degree in computer science, and his hobbies are reading science fiction and comic books.

When David asked me to do an article for the tenth anniversary issue of *Creative* I knew I couldn't refuse. As the original microcomputing magazine and the first licensee of my Adventure games, *Creative* has always held a special place in my heart. Not only that, but David Ahl is one of those people you instinctively like from the beginning. I knew I couldn't say no, but that still left me with a bit of a problem.

In the past I have almost always refused requests to do magazine articles (interviews I always give, articles I rarely do) because I have found that for me, writing (other than computer programs and Adventures) is like trying to pull teeth. But what the heck, here we go . . .

David has given me free rein on what to discuss here in this auspicious issue, so I decided it would be only right to go back to the early days of this industry. Keeping in mind what I said about pulling teeth, I ask your forgiveness in advance if I tend to ramble.

I, like many pioneers in the microcomputer industry trace my roots back to the time when there was no industry. My first exposure to microcomputers still stands out vividly to me today. I can remember that one of the instructors at FIT, the college I was attending, brought in a little black box he had developed. It was a 4004 microcomputer with 256 bytes of RAM and a dozen or so switches on the front.

The 4004, one of the earliest of the microcomputer chips, was later superseded by the 8008 and the 8080, which grew into today's 8086 processor, I remember looking at the simple programs he was able to put in through the switches on the front panel and thinking that if this was a microcomputer, you could keep them—what a waste of time! I had been using mainframe computers since 1968 when I was in high school and couldn't conceive of ever wanting to own of these simple toys.

Looking back, I see my first true commitment to micros came a while later. My brothers Eric and Richard and I were living in a house in Melbourne, FL, while attending FIT. Richard was an EE major and was fascinated by new technologies. He picked up some bit slices for an IMP-16 microcomputer. A bit slice micro was rather interesting; instead of having the whole computer on one chip, you would hook together many chips to increase the power of the CPU.

Richard went ahead and built one of the earliest 16-bit hobby computers ever assembled. He had, I believe, about 1K of 16-bit memory, a TV as a monitor, a keyboard, and a cassette port for data storage.

My own love of computers had always been in games (my first major program was a tic-tac-toe program written in APL/360 at North Miami Senior High School), so when I realized that Richard actually had a working machine, I decided to see if I could program some sort of game into it.

Hooked on Micros

I wanted to do a real time arcade type game (remember this was in the early days of Pong and other revolutionary programs), so I decided to do a space war game. What I came up with was a precursor of a very popular game put out by Atari many years later—*Asteroids.* Not having any software for the machine, I had to write the program in assembly language and then hand assemble it. It was a labor of love. Once I had the game up and running on Richards's computer, I knew I was irrevocably hooked on the micros!

> *My first major program was a tic-tac-toe program written in APL/360 at North Miami Senior High School.*

Here at last was a computer that allowed me to do with computers what I loved the most—write and play games. And all from the comfort of my own room. My next step was to get my own machine. I didn't want to follow quite the route my brother did, as I was more interested in programming the computer than in designing it, so I tried to find a kit. (This was long before Heath introduced the first Heathkit computer.) At that time, the only computer system on the market was the MITS Altair, which used the 8080 microcomputer chip.

I got a copy of the machine language commands for the machine and instantly disliked it. After working for years on the large mainframe computers with their 32-bit instructions and even on my brother's 16-bit machine, I felt the opcode set on the 8-bit 8080 was a big step down. But then I got a copy of *Radio Electronics* magazine and things started looking up.

In the back was a small ad for a Sphere microcomputer kit, which used the 6800 microprocessor and had 4096 bytes of memory and a 512 byte ROM monitor all for the low price of $650. It seemed the perfect machine for me. Later I discovered that mine was the very first order Sphere received for their computer.

The 6800 (precursor to the 6502 and 6809 so popular today) was also an 8-bit micro, but it had a much more powerful instruction set than the 8080. After many months, my kit finally arrived. By the time I sold the machine years later, I had written an assembler, a Basic and a large number of games and increased the memory space to an unbelievable 32K.

Reading Matter

About the time I received my Sphere, I realized that I was really hooked on microcomputers, so I started looking around for further reading materials. My collection of *Byte* magazine starts at issue 2, October 1975, and my first issue of *Creative Computing* is the Sept-Oct 1976 issue, Vol. 2 Number 5. Looking back at those early years of *Creative Computing* it is fascinating to see how the industry has changed.

In the Sept-Oct '76 issue, there were 98 pages; there were so few companies to advertise back then that there is not even an Advertiser's Index in that issue (the first Index appears in the Jan-Feb 1977 issue). There were fewer than 15 pages of ads, most of which were for *Creative Computing* itself.

Back then $400 would get you a kit with around 2K of memory, no keyboard, and a TV monitor hookup. You could spend around $700 to add 16K of memory, $200 for a keyboard, and $400 for an 8K Basic. Compare that with today's prices for a 16K assembled computer with keyboard and Basic built in for under $100! Remember also that eight years ago the dollar really went much further than it goes today. It will be really fascinating to see what the next ten years bring.

In the Nov-Dec 1976 issue, *Creative Computing* ran a two-page list of all known computer stores in the country. Without having to resort to other than normal type, the fewer than 100 stores were easily listed. At the end a promise was made to update and publish this list twice a year. Imagine a similar list today and the size of the book needed to hold it. I expect that by the year 1990 computers will be available as readily as record players are today and not just here in the high tech U.S., but worldwide.

The 1950's were the age of the atom, the 60's the jet age, and the 70's the space age. Is there any doubt in anyone's mind that the 80's will be regarded as the dawn of the computer age? Thinking about the articles to be written for the 20th, 50th and even 100th anniversary of *Creative Computing* leaves the mind numb! Watch out; computers are here! ■

FLYING HIGH/DAVID LIEN

David Lien, one of the early microcomputer authors, is recognized as the originator of the tutorial style computer manual. With 18 full-length technical books to his credit, he has more than two million copies in print, including such best-sellers as The Basic Handbook *and* Learning IBM Basic.

He assisted in the development of the original TRS-80 Model I, wrote the manual that accompanied it, and is often identified with its success. He also wrote manuals for the highly successful Epson MX printer series. Lien is president of San Diego-based CompuSoft Inc., a publisher of what he calls "Mercedes-quality computer books."

All's quiet above the South Atlantic except for the sound of clicking keys. It's fitting that my thoughts about the last decade are entering this "briefcase portable" computer. Ten years ago such technology was barely dreamed of, but in 1984 it too is flying high.

In a few hours this ride will end. The wild ride of the personal computer will also end as it settles in as a serious part of everyday life. I wonder what the next shooting star will be, and where to buy a ticket?

Technological and social innovations often drift in directions not envisioned. Some of the fun of this computer revolution is over. Many old hackers have disappeared, replaced by peddlers and other scoundrels in three-piece suits whose qualifications consist of selling shoes or a degree in computer science. Our hobby, begun by fiddling with batteries, switches and light bulbs has, at our own hand, become an industry.

Oh, it is exhilarating, and breathtaking, and lots of fun! But it is also like being accelerated to Mach 10 without benefit of a space suit.

I researched and wrote The Original Tandy *Learning Level* I and *The Basic Handbook* during idle moments in a 12-foot travel trailer out on the desert. That was many books ago. Haywired breadboards were called computers and even worked sometimes. Sure, that struggling was lots of fun.

But can you imagine what an empty feeling it gives an old hacker to see something work right *the first time?* The profusion of sophisticated hardware and software that *works* today is absolutely amazing! We still can't understand the instructions, but that is another story.

My little travel trailer is now a booming business with buildings, management, researchers, support staff, and accountants, plus lawyers and other parasites, and a playpen full of personal computers. But I still have the 12-foot trailer. (Am thinking of having it bronzed.)

I have taught the Basic language to millions of people in the last decade, and plan on teaching it to millions more. Each book reaches more students than are seen in an entire career in the classroom.

I am still at the leading edge writing books about mice, Unix, windows, hardware and more. Only the nimble survive. The reality that computers are no more just for hobbyists dictates that the emphasis move to applications.

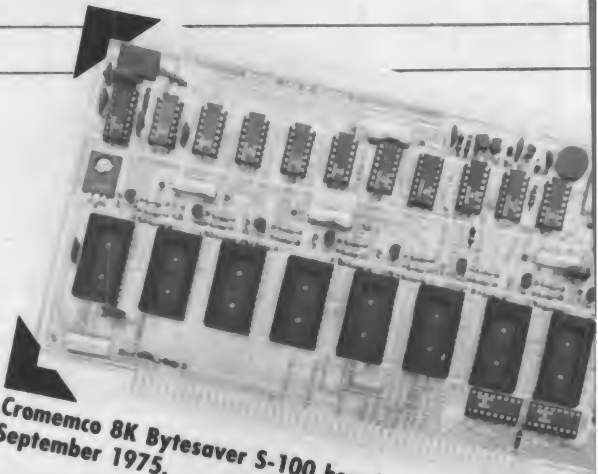
The majority of tomorrow's computer users will not be enthusiasts like us. They will be civilians with a job to do but no time, patience, or desire to fiddle with machines. They need simple solutions to complex problems and computers that do useful things easily. The hardware manufacturers, and software and book publishers who succeed in this environment will be those who dedicate themselves to those most elusive goals: quality, simplicity, and the minimizing of pain.

So here we are, flying high, wondering who will land where. The winners will be those who find vacant runways among dense populations. The losers will just sit on their automatic pilots until they run out of gas.

The future should be at least as interesting as the past. And maybe even as much fun. ■

DAVID AHL

PEOPLE & PLACES



Cromemco 8K Bytesaver S-100 board, September 1975.

John Mauchly (speaking), John Dilks (seated) at the 2nd Atlantic City show, August 1977.

Lou Fields of Southern California Computer Club presents award to Carl Helmers of Byte at WACC, March 1976.

David Ahl and Betsy Staples relax a bit before the West Coast Computer Faire, March 1982.

Scrounging for parts at the Trenton Computer Festival flea market, April 1979.

Roberta and Ken Williams at the fourth birthday party of Sierra On-Line, Coarsegold, CA, June 1984.

David Bunnell speaking at the first Personal Computing Show, Chicago, September 1977.

Debugging boards at IMSAI, May 1977.

Webb Linzmayer's flea market booth at fourth Trenton Computer Festival, April 1979.

The Orange, first Apple imitator, at the West Coast Computer Faire, April 1979.

Mike Scott (L), president of Apple, talking to Chuck Peddle of Commodore at CES, June 1978. Shortly thereafter, Chuck joined Apple for a short stint.

Overhead view of the first West Coast Computer Faire in the Civic Auditorium, San Francisco, April 1977.

Reminiscence: Software, Stores, and Magazines

No one can help but be amazed at the developments in technology and hardware because they are so obvious: a quarter square inch of etched silicon replacing literally a room full of vacuum tubes. But equally amazing is the fact that today, a computer can be used effectively by an average person rather than a highly trained cadre of mathematicians, engineers, and technicians. For bringing the computer to the level of the people, we can largely thank user-friendly software, widespread stores, and informative magazines.

Perhaps as deeply involved as any company in software is Microsoft; Bill Gates tells us about the company and its philosophy. *VisiCalc* is credited with being the first software product for which people would buy a computer; designers Bricklin and Frankston tell us how it was in 1979.

Many founders of software companies left good paying jobs for the vagaries of entrepreneurship; Ed Zaron of Muse Software tells us about his experiences starting up. Other software authors were frustrated with the current offerings and tried to go one better; Michael "Electric Pencil" Shrayer and David "Datamost" Gordon tell us about their approaches. ■

Selling product, setting up systems, personal handholding: these are just some of the roles of a computer store. Stan Veit tells us about the first store east of the Rockies. In the early days, open-to-the-public computer centers also played an important role in spreading the word. David and Annie Fox tell the story of one such center.

How did people throughout the nation, indeed the world, learn what amazing things were going on in a storefront in Albuquerque, a garage in Sunnyvale, or a converted pizza parlor in Atlanta? Magazines, of course. Tom Dwyer recalls the first ones and tells how the articles could be used for real learning.

What was it like producing a magazine on a shoestring? It was desks in stairwells, 10 cps printers, and lost manuscripts. David Lubar tells all about the early days of *Creative Computing*. But there were competitors; David Bunnell, Wayne Green, and Carl Helmers tell us about some of them. ■

A TREND TOWARD SOFTNESS/ WILLIAM GATES

William H. Gates, chairman and CEO of Microsoft, formed his first computer-oriented company while he was still in high school. Gates and Paul Allen were founding partners of Traf-O-Data, a firm specializing in computer analysis of traffic patterns. In 1974, Gates and Allen developed the first high level language for microcomputers, Microsoft Basic, which became part of the first personal computer, the Altair, and has been used on most personal computers, including the Pet, Commodore, Apple II, and the IBM PC. They then founded Microsoft to develop and market software for microcomputers.

Gates, who had attended Harvard University, left college to take charge of Microsoft's day-to-day operations. He currently manages Microsoft's development teams directly and was involved in the design of MS-DOS, the Radio Shack Model 100, and most Microsoft applications.

Microsoft has been directly involved in the most exciting events in personal computer history: the first personal computer (the sometimes forgotten Altair), the Apple II, design of the IBM PC, the Radio Shack Model 100, and most recently, the Apple Macintosh. However, one of the most interesting discoveries for me came in 1973, even before the Altair, when Paul Allen and I started working with the first general purpose 8-bit microcomputer, the Intel 8080. It was then that we discovered two principles that would shape the industry.

The first was that, over time, general purpose devices with less and less specialized "programming" would replace specialized devices. We saw this initially when microcomputers replaced discrete circuitry. The first use of a microcomputer was to simplify a calculator; later, even the logic of the microprocessor was replaced with a microcode program on the microcomputer chip itself. Specialized word processors are being replaced by general purpose microcomputers.

The Trend Toward "Softness"

I call this a trend toward "softness." Today we are talking about "writable control stores" in which the microcode in a microprocessor can be changed, allowing for specialization of the instruction to gain efficiency based on the specific problem being solved.

Even in software this trend has become obvious. Rather than build up from a bare machine, a general operating system is used to allow the specialized application to be simpler. The operating system is now evolving to include graphics, as in the Microsoft Windows system; multitasking; and higher level data mangement operations. This even further reduces the amount of work required to specialize a machine since all of the new subroutines in the operating system are available.

This trend toward general purpose devices may seem illogical, since a specialized device can be simplified and streamlined for its particular purpose. However, the benefits of this tuning are being increasingly outweighed by the extremely low cost of the general purpose device which is being sold in very high volume and the design of which is receiving the very best design expertise. Both hardware and software improve greatly when volume is high and the best talent is applied.

In the future, software packages will become even more general purpose as they remember all of the user's input and mold to his profile and communication techniques. Of course, this is a form of artificial intelligence, which is a very advanced form of "softness," since it attempts to create a device so general purpose that it can deal with a vast number of inputs and recognize important patterns.

Third Party Support

Another crucial principle is the importance of designing open systems that allow everyone to build on them and building a "standard" by encouraging third party support. Microsoft, Apple, and IBM all owe their success in personal computers to

this approach. Because the Intel 8080 was the first chip, everyone wrote software for it.

When the Motorola 68000 came out years later, it wasn't enough of an improvement to justify rewriting all the software and despite its superiority, it did not do as well as the 8080 simply because Intel had encouraged software development and good development systems.

Likewise, Microsoft Basic gained a position because of the incredible number of books, courses, and applications which employed it. The momentum that these third party investments can create is amazing. Today there are faster systems than the IBM PC, but software solutions aren't as widely available. The Apple II was designed more than six years ago yet it is still a best seller. These *de facto* standards were created because the world at large was encouraged to take advantage of these products.

Standards are so beneficial to end users that they can hold back technological advances for a short time, though innovation eventually requires a new generation. In every new generation, however, many, many products are engineered but only a few are merchandised to developers in ways that allow them to become successful. The investment Apple has made to encourage applications for the Macintosh is a result of their understanding of the value of widespread support.

I realized the value of third party support when I saw that the Intel 8080 software quickly became better than minicomputer equivalents simply because so many companies were building and sharing software tools. It is for this reason that Microsoft has always made its product very open.

Despite the instability of companies in the personal computer industry (our first 12 customers all went bankrupt) where surprises are commonplace, the use of general purpose devices and third party support have proven to be the principles that drive the industry. ■

VISICALC '79/ DAN BRICKLIN AND BOB FRANKSTON

Software Arts introduced *VisiCalc* to the world at the National Computer Conference in New York in 1979 when *Creative Computing* was only five years old and personal computing was not even that old. Many, if not most, of those who have joined the industry since then view *VisiCalc* as a given, as the *sine qua non* of personal computing. For many it was reason enough to buy a computer.

In the intervening years, *VisiCalc* has spawned a myriad of spreadsheets, enhanced spreadsheets, and integrated packages that almost qualify as an industry unto themselves. People who buy computers today assume that spreadsheet capability and "what if" analysis are part of the deal. Some are even willing to pay more for their spreadsheets than they do for their computers.

VisiCalc is, indeed, one of the all-time great success stories of the decade. But where did it come from? Whose idea was it? What inspired its creation? Dan Bricklin and Bob Frankston, cofounders of Software Arts, take a look back and tell us how it was.

Dan Bricklin

Not long ago I realized that there was an ironic coincidence having to do with the development of *VisiCalc*. Bob Frankston and I were working on *VisiCalc* while I was still in business school. (I spent afternoons working on *VisiCalc* in Bob's attic while carrying a full course load.) When we had an early prototype version that worked—it didn't perform division or print the results, and the replicate function didn't work yet—I decided to use the program to prepare a case that I had to write up for my Consumer Marketing class at Harvard.

At that time, my fellow students were using hand calculators to "run the numbers" for the analysis of cases. I wasn't telling many people about *VisiCalc*; I wasn't even sure the professor would look favorably on my use of a computer to do the numerical analysis. Now, of course, Harvard Business School students are required to buy personal computers so they can use spreadsheets in their analyses.

The first case analysis I did using *VisiCalc* was very well received by the professor. In fact, I was easily able to project results five years ahead instead of the usual two years. That case study proved to me for the first time that *VisiCalc* was, indeed, very good in at least one of the areas for which it was designed: solving business problems. A few years later, I was struck by the irony of the situation when I recalled that the very case I used for the "maiden voyage" of *VisiCalc* concerned Pepsi and the Pepsi Challenge campaign. (In my paper I recommended that Pepsi go ahead with that advertising campaign.) Of course, John Sculley was the head of Pepsi then, and I find it ironic that he now heads Apple Computer, a company whose early success was tied closely to the success of *VisiCalc*.

Bob Frankston

The rapid changes that *VisiCalc* brought about in personal computing are demonstrated in the status of personal computers at the National Computer Conference. In 1979, the National Computer Conference did not officially include personal computers; there was an adjunct Personal Computer Festival at which I spoke. Somehow my paper was never published in the official proceedings of the conference. I guess at the time it was

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considered less important than some of the other papers such as "Visual Inspection of Metal Surfaces" which appeared in the published proceedings.

I made my presentation to a group of about 30 people, most of whom were friends and relatives. At the session, I had the program disk and a reference card with me. Dan and I wrote the reference card, took the screen photo that appeared on it, and chose the type for the typesetting. Dan's father, who is a printer, did the printing. That was the state of the industry in 1979 as observed at the NCC.

By 1982 the industry had changed so much that personal computers were a major part of the NCC, and I was in charge of the personal computing part of the conference. Now, of course, personal computers dominate the exhibition floor at the NCC, and I predict that in few years the big computers will be relegated to a "Big Computer Festival" tacked on to the main National Computer Conference. ■

ZARON AND THE ART OF MOTORCYCLE MAINTENANCE/ ED ZARON

Until 1978, Ed Zaron worked as a computer analyst for a large financial organization in Baltimore. Within a few years he bought an Apple, swamped his dining room with programming notes, quit his job, founded Muse Software, and, with Silas Warner, published Castle Wolfenstein, Robotwar, *and* Super-Text Word Processor, *some of the industry's best-selling computer programs. Muse Software is now a multi-million dollar developer and publisher of educational, entertainment, and productivity software.*

Q: You often refer to computer programmers as computer artists. Lots of people would see computer programming as dry and technical. What is artistic about computer programming?

Ed Zaron: Good computer programmers have individual styles as all artists do. A programmer has as many choices in programming a word processor or game as a painter has in painting a still life or a writer has in writing a love story. It is in making those choices that the programmer develops his own style and rhythm and becomes an artist.

Q: Before you got into computers, did you have any forms of creative expression?

E.Z.: Sure. It probably started with Lincoln Logs, putting them together, taking them apart. Then I graduated to mechanical things like clocks and toys, and then I got into motorcycles. When I started to modify and re-design motorcycles, that's when I became a kind of motorcycle artist. But later I found out that computer programs are like the ultimate motorcycle. The parts don't cost anything. If you need more, you just hit your keyboard; your hands don't get dirty; and if it doesn't work or if you don't like the way you put it together, you just throw the parts away and start all over again. It's pure. Good ideas in . . . Creative programs out.

Q: How did you get from motorcycles to computers?

E.Z.: I went into the Air Force in 1964 and in 1965 I had heard about computers so I got myself into a computer class. And I liked it. I figured if anybody was going to pay me to have fun, I'd be more than happy to do it. So when I got out of the service I applied for a job at Commercial Credit as a programming trainee. I remember it was a Friday and they said well, we have a class starting Monday, but you're too late to get into it. But they said if I wanted I could take the test and if I passed they would call me in six months for the next class. So I took the test and I got the highest score they had ever seen. They put me in that next class Monday morning and I fell in love with the whole thing. I graduated with the highest grade in the class and I knew for sure I was where I belonged.

Q: So at this point you're into computers. How did Muse Software happen?

E.Z.: Well, mostly it was a lot of fun. I guess it all began one day at work back in February of '78. Silas Warner worked there, too. He was just an acquaintance of mine, and I mentioned to him that I was going to buy an Apple computer that night and how excited I was about it. But I really didn't know him that well. After work I went to the computer store. I brought the computer home, and I was taking it out of the box when the doorbell rang.

It was Silas! I barely even knew him, and he just walked right in to see my computer. Well, Silas is the kind of guy who can rub a manual across his chest and understand it completely. It is not uncommon to see him reading three books folded one inside the other.

Silas is the kind of guy who can rub a manual across his chest and understand it completely.

So he sat down in front of my computer and started to write programs. I just sat there and watched.

Well, hours went by and I was just watching. Finally I said, "Umm, Silas, I have to go to a party." He said, "That's okay. I'll lock the door when I leave." Now I couldn't believe this was

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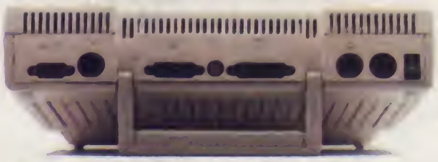

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Photography by Barbara Kasten

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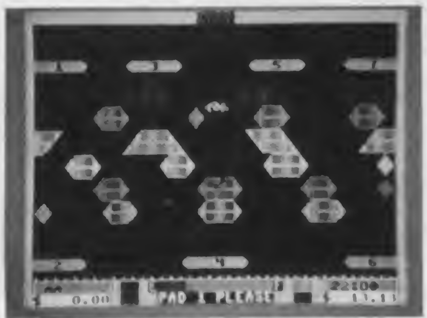
happening, but I went to the party, and when I got home around 1:00 a.m. Silas was still there. He had a couple little games running on the computer. One of them he called the Apple Tree, and to play it you had to catch apples falling off a tree. A simple game, but he had written it the first night he had touched the computer. He bought a computer the next day, and we began hanging out together.

Q: Sort of the first Apple Users Group, you and Silas?

E.Z.: I guess we were. I just fell in love with the computer. I would think about it all day at work, and when I would get home I would drop my jacket on the chair next to it and sit down and work until I couldn't stay awake any more. Go to sleep, go to work, come home, sit down at my computer again. Some time in February I finished a game called Tank War, and Silas finished a maze game. So we took them to computer stores and were just amazed. People would gather around to see our games and sigh and go "oooh" and "aaah" as they saw their first software. It was a great thrill. Oooh and aaah. Really. It was just like that. It makes you feel so good when people like it.

Q: What was on the market at that time?

Early games had only one screen such as this one of Apple Tree.



Current games have as many as 24 screens; here is one screen of Space Taxi.

E.Z.: Nothing.

Q: Not even Pong?

E.Z.: There was a Pong game and a Breakout game. But people had already seen them in the arcades. And even in the arcades they were very basic compared to what Silas and I were coming up with for home use.

Q: How much did you sell back then?

E.Z.: We sold a couple. We'd sell a couple here and a couple there. At that time there weren't many stores to sell in. By April we had half a dozen programs done, so I went to the Trenton State Computer Fair in New Jersey. I went up there with an old folding card table, a lawn chair, and my computer—and the programs. They had a flea market in the parking lot, and the gymnasium was set up like a trade show. But I couldn't afford to get inside for the trade show. I ran an extension cord through the window and set up my own little booth on the sidewalk and caught people going in and coming out. I remember the excitement at the end of the day. My son was with me, and we had sold $360 worth of cassette tapes. We were amazed.

Q: Cassette tapes? Not on disk?

E.Z.: There were no disks at the time. It was interesting, too, the way we made those tapes. We'd load the program into the computer, and it would take two minutes to dump the program onto tape—these programs were not very long either. Then we'd spend two minutes loading each copy to test it. One night after spending four hours making copies, I went to test them and found out I hadn't even had the cassette machine plugged in. I stayed up all night more than once.

Q: It sounds like you started Muse on a shoe string.

E.Z.: I did. I remember I did the packaging for *Tank War* for $17. To do all the advertising and promotion you have to do these days costs between $20,000 and $40,000. And those are just the starting costs—just to get the program to the distributors and into the stores for their first order.

Q: How does a programmer—a computer artist—get started today if he doesn't have $20,000-$40,000 to get going?

E.Z.: It's like writing a book. You don't have to be a publisher to write a book. When I started there weren't any software publishers, so I had to build the whole thing myself. But now you can write a good program and take it to a software publishing company to see if they'll put it on the market. If they like it, they arrange to publish it and pay royalties just like in the book or record business. If they don't like it, they give you a critique and help you figure out how to make it better—at least I know Muse will.

> *The best training is to get into that computer and learn it for yourself just as the best way to learn to ride a motorcycle is to jump on.*

Q: What kind of computer school should an aspiring young computer artist go to?

E.Z.: I don't think it's absolutely necesssary to go to computer school. Maybe the best training is to get into that computer and learn it for yourself just as the best way to learn to ride a motorcycle is to jump on. You will find ways to do things that nobody has ever seen before. That's how John Kutcher did it. He just bought a Commodore 64 and went to it. He learned the whole thing himself.

Q: Who is John Kutcher?

E.Z.: He is a 17-year-old prodigy. He wrote two dynamite games we published. One is called *Rescue Squad,* and the other is *Space Taxi.* They are brilliant pieces of work, and perhaps by the time this article is published, they will be best-sellers.

Q: What makes him so exceptional?

E.Z.: John has a very rare combination of talents. He can relate to what the consumer wants, he is disciplined and he is creative. There are many ways those characteristics can interfere with each other, but John has them all in the proper balance.

Q: One final question. Why do you like motorcycles so much?

E.Z.: For the same reasons I like computer programs even more. They are streamlined. Generally speaking, the simpler the better. The trick is to build a lot of power into a small and maneuverable space. And they represent a sort of freedom. A kind of zest and excitement. That's the kind of motorcycle I like. And that's the kind of software I design and publish. ■

CONFESSIONS OF A NAKED PROGRAMMER/ MICHAEL SHRAYER

On Michael Shrayer's twenty-third birthday, the term "text editor" burst into Shrayer's awareness with an impact that provided momentum enough to direct the thrust of his mental energies for the next several years. He used the last of his savings to purchase a MITS Altair and quickly completed his text processor, Text Editor #1. To document it, Shrayer developed a word processor: the Electric Pencil.

The success of the Electric Pencil *has meant that Shrayer is free to work on software projects of his own choice; usually he has several programs under development simultaneously. For the last few years, he has been working on projects that were forced onto a back burner during the earlier phases of his career. Currently, he is putting the finishing touches on the* Electric Wren, *the first bird processor ever to run on a microcomputer.*

It feels kind of funny writing a piece about the "good old days" of microcomputing. I see them more as the bad old days. This is a very progressive industry, and things are a lot easier now than they used to be—except marketing, perhaps, but marketing isn't my specialty.

In the old days, you had to hassle with front panels, hardwiring and hand entering monitor programs and cassette I/O routines via switches or numeric key pads. Nowadays, the hardest part is opening the bubble package the software comes in.

To me, making things easier has always been the name of the game. I think that is the way most people feel. Almost all of us look forward to the day when we will no longer have to go to an office to earn a living. The objective is to be able to work at home or not to have to work at all.

I see computers (and technology in general) making it possible for many of us to work at home in the near future. With high speed telecommunications, video recorders, holography and the like, why should anyone have to go to a particular locale to be "on the job"? In a few years, modern communications will be able to put you literally face to face with anybody in the world.

Personally, I achieved a state of independence years ago that freed me from the obligation to leave my house to go to work. Nero Wolfe, eat your heart out! Since I don't usually wear clothes in bed, a big problem (for me) is finding my bathrobe so that I don't freeze on my way to the next room where my work station is. But of course on warm days, even that is not a problem.

Actually, I prefer working in bed, but I find handling the computer a little awkward when I'm under the blankets. Maybe an improved version of the IBM PCjr keyboard will be the next step—an X-ray keyboard instead of infrared.

I work at home on tasks of my own choosing. If you are wondering why you haven't seen too many new Michael Shrayer products lately, it's because the software I write is so esoteric that I am the only person who cares about it.

On Electric Pencil

A notable exception to this is IJG's IBM version of the *Electric Pencil.* Unlike all the other versions of *Electric Pencil,* the IBM version is not a rewrite of my original word processor. It was rebuilt from the bottom up. I worked on the design philosophy with Dale Buscaino and Scott Daniel of Progressive Software Design, and my old friend, Harvard Pennington of IJG. The result is a much better word processor than anything we had in the "good old days"—better than any other word processor I've seen around these days too.

There are many features in IBM *Pencil* that I never thought of putting in the older versions. It is not that the machines we had then weren't sufficiently powerful—many of them were. It is largely because I never did enough writing to appreciate fully the many features that writers find so very important.

I developed the original *Electric Pencil* to document something called ESP-1. At that time, I didn't even know that a product like *Pencil* was called a word processor. In fact, *Electric Pencil* was the first word processor ever written for a microcomputer.

I used *Pencil* to document ESP-1 and then itself. The *Electric Pencil* was always very popular. I think that's because my dedication to the ideal of eliminating all unnecessary labor from a task resulted in a product which was very easy to learn and use.

You may be getting the idea that all I am interested in is staying in bed and playing with computers. That's not at all the case. For instance, I have several hobbies. I have a ham radio license, and I have studied firearms.

On Work

I am attempting to find a vocation that combines my various interests. I tried to get a job with the FCC shooting computers that emit too much TVI (Television Interference), but they were already swamped with applicants.

Speaking of jobs, I may be fostering another misimpression here. Some people think I am lazy. My late father thought that I never had a real job in my life. Actually, I have held a variety of jobs ranging from intense physical labor to pure cerebration. I also worked in the film industry for about 20 years, producing and directing commercials, industrials, and documentaries as well as TV and theatrical stuff.

The work I do now isn't easy, ei-

ther. It doesn't have much practical application; it is not very physical; and I like to be as comfortable as possible while I'm doing it. But it is taxing mentally, as is any substantial programming project.

I always prefer to work in assembly language. I like to get right in there, up tight to the machine, and hug it. In the old days, you didn't have much choice.

As much as I like to knock the bad old days, I have to admit there was a level of excitement back then that is gone now. It really gives me a tingle to remember the adventure inherent in simply upgrading your system.

> *I prefer working in bed, but I find handling the computer a little awkward when I'm under the blankets.*

On User Groups

Circa 1975, George Tate and I used to run around LA visiting every electronics surplus store we could find, looking for anything that smelled like a computer. Once we bought about 30 dilapidated Burroughs terminals. As you would expect, they were basically keyboards with CRTs.

We managed to scrounge about 20 good terminals out of the 30 junky ones. We figured they were good because they worked in the local mode. But we had no idea how to go about interfacing them with a microcomputer, or even if it was possible.

We brought them all to a meeting of the burgeoning Southern California Computer Society (SCCS), which was then meeting at TRW, and set the terminals out on a table. We informed the group of our ignorance about interfacing the things. Though no one there knew any more about the subject than we did, we still hoped we could sell a few. To our amazement, we sold most of them almost immediately.

The SCCS, by the way, grew by leaps and bounds. It seems to me that at one of the early meetings, there were just a few people, then scores at the next, and hundreds at the one after that.

On Imsai

Imsai also had a meteoric rise. I remember looking at one of the first Imsais. The thing that made the biggest impression on me was its crudeness. The next thing I knew, Imsai was a giant.

When Imsai was still just an upstart, most of us had Altairs. Altair was made by MITS which was located in Albuquerque, NM.

Whenever people arrived in town after passing through Albuquerque, we would grill them for hours on what was happening there—was anything new being developed, when could we get more memory, etc.

On New Computers

Nowadays, you can (within the constraints of your checkbook) upgrade your system whenever you like. You can buy disk drives, printers, whatever, and just connect them to your computer. We used to have to wait months just for a memory board.

When the Commodore Pet and the TRS-80 first came out, I wasn't very excited. Not many of us "old-timers" were. In fact, I hated the TRS-80; it insulted me. Nonetheless, I bought one of the earliest ones, almost by reflex. At that time, I was buying almost every new computer available.

Today it seems that five new computers are announced every week, but believe me, then it was a rarity. In spite of that, I never bought a Pet. I thought the TRS-80 might succeed by virtue of Radio Shack's jungle of retail outlets, but I didn't think that Commodore had much of a future. Live and learn. At least I was half right.

Another reason I stayed away from the Pet was that it ran a 6502. I have studied 6502 assembly language and have always had an aversion to it. I know people who claim that when similar routines are written in both Z80 and 6502 code, the 6502 versions are faster, more compact, and more readable. Those people remind me of the Forth fanatics who try to persuade me that Forth programs execute faster than their machine language counterparts—and of people who tell me why they buy Saabs.

Before you accuse me of being a Z80 diehard who refuses to get used to a new instruction set, you should know that I have a TRS-80 Model 16B at home, and when I saw what 68000 assembly language was like, it was love at first sight.

I do try to program in C, so that if, God forbid, I accidentally create something practical, I won't have to go through the same contortions I did with *Pencil* to adapt it to all the popular systems. But it takes iron discipline to keep myself from going back to programming the 68000 directly.

People who have spent their lives working with mainframes might look down their noses at Motorola's instruction set, but to someone with my background, it's heaven.

Which brings me back to the inescapable conclusion that no matter how nostalgic I may feel about the early days of our industry, it would be a misnomer to call them the good old days.

Now I have to transfer this file from my Model 100 to my Model 16B so I can save it to disk. Now let's see, where did I leave my bathrobe. . . . ■

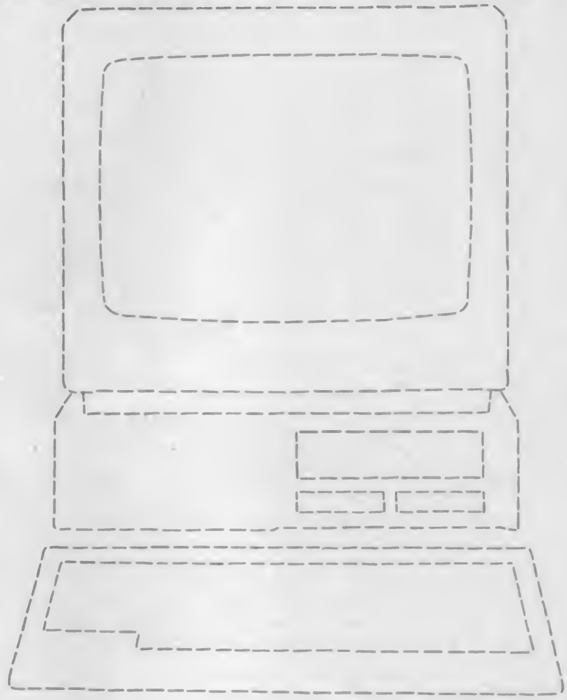
WHAT THE COMPUTER INDUSTRY MEANS TO ME/ DAVID GORDON

I guess you could say I'm a gizmo freak. With my background in business —I was a tax accountant for 14 years—I had had a lot of experience with computers. So, in 1977 when home computers were first introduced it was not surprising that I was "bitten by the computer bug."

At one point I actually had made full deposits for both a Commodore Pet and a TRS-80 computer, hoping to buy the first model that arrived. Then in December 1977 Apple Computer reduced the price of their home computer from $1795 to $1995 and I was able to buy an Apple—at the time the Cadillac of the home computer industry—by collecting my deposits on the Pet and the TRS-80. I took the plunge and joined the microcomputer revolution.

The field of microcomputers has always appealed to me for two reasons —making money and having fun. I

Picture a computer under $1000 that runs over 1000 of the best programs written for the IBM PC.



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There's a lot that's new about PC*jr* and it's all good news for you.

PC*jr* now has a lower price.

A new typewriter-style keyboard.

A new option that can give user memory a dramatic boost.

And new business and personal programs to add to its fast-growing library of up-to-date programs.

All of which can make PC*jr* the most useful computer a little money can buy.

Right now, PC*jr* can run the powerful Lotus 1-2-3™ on diskette (with Lotus 1-2-3 PC*jr* Installation Kit and additional memory). The new cartridge version, requiring no additional memory, will be available this fall.

Managing Your Money™ by Andrew Tobias, new on cartridge for PC*jr*, is a comprehensive personal financial advisor and manager.

Turn your screen into a canvas. The new cartridge program, PC*jr* ColorPaint, lets you create with the added dimension of color.

It comes standard with 128KB of user memory—twice the memory of its most popular competitor. An advanced 16-bit processor. And a double-sided diskette drive that can store over twice as much information as most single-sided drives.

The new PC*jr* Memory Expansion Attachment can give memory a quick lift to 256KB. Or, along with a PC*jr* Power Expansion Attachment, all the way to a hefty 512KB.

With all these features, PC*jr* can run over a thousand of the most popular programs written for the IBM PC. And with the new optional 128KB Memory Expansion Attachment, it can run over a thousand more.

PC*jr* also runs a growing number of powerful cartridge programs. They work faster than diskettes, and don't take up a bit of user memory. The three newest examples being Lotus 1-2-3,™ the fascinating PC*jr* ColorPaint and Managing Your Money™ by financial expert Andrew Tobias.

As its library of software keeps growing, PC*jr* keeps growing, too. By leaps and bounds. Because IBM designed it with 13 ports for add-on options. And a modular construction that will accept new capabilities down the road. Even those that haven't been invented yet.

All this in a computer that weighs a mere 10 pounds.*

Takes up just a bit over a square foot of desk space. And costs less than $1,000†, without monitor.

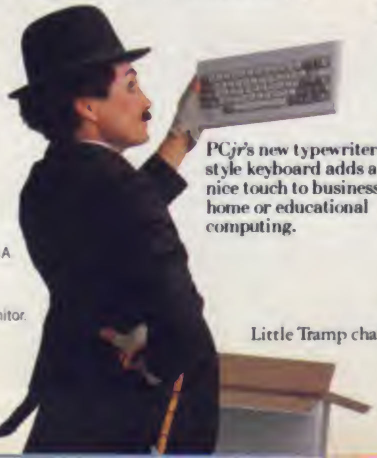
Picture yourself with a PC*jr*. Try one out and see what's new at an authorized IBM PC*jr* dealer or IBM Product Center.

For the name of the store nearest you, call 1-800-IBM-PCJR. In Alaska and Hawaii, call 1-800-447-0890.

More computer for your money.

See how PC*jr* compares with other computers at its price.

Memory User Memory (RAM): 128KB (expandable to 512KB) Permanent Memory (ROM): 64KB	**Software** Runs over 1,000 programs written for the IBM PC Runs both diskette and cartridge programs
Diskette Drive Double-sided, double density Capacity: 360KB	**Display** 40- and 80-column Resolution: 4-color: 640h x 200v 16-color: 320h x 200v
Processor 16-bit 8088	
Keyboard Typewriter-style Detached, cordless	**Expandability** Open architecture Optional 128KB Memory Expansion Attachment(s) 13 ports for add-ons, including built-in serial interface
Warranty 1-year limited warranty	



PC*jr*'s new typewriter-style keyboard adds a nice touch to business, home or educational computing.

IBM PC*jr*

Growing by leaps and bounds.

CIRCLE 154 ON READER SERVICE CARD

*Weight does not include power pack and monitor.
†IBM Product Center price.

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ProModem™ 1200A Apple Card Pack

It's the best 300/1200 baud 212A telephone modem for your Apple® II, II+, and IIe. "Best" because it's the easiest to install and use, provides more useful modem features for your money, and lets you add software capabilities as your needs grow.

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(1) ProModem 1200A Apple Card Pack, complete with on-board software and all necessary hardware
List Price: $449

HAYES

(1) Smartmodem 1200 "standalone modem"
(2) Serial Card
(3) RS-232C Cable
(4) Communications Software
Total List Price: $957

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The "Help" Screen and "Auto redial if busy" functions make the 1200A convenient to use. The second phone jack for the telephone handset allows switching from voice to data. You get all of this, ready to use, complete with easy to understand documentation, and a telephone cord for only $449.

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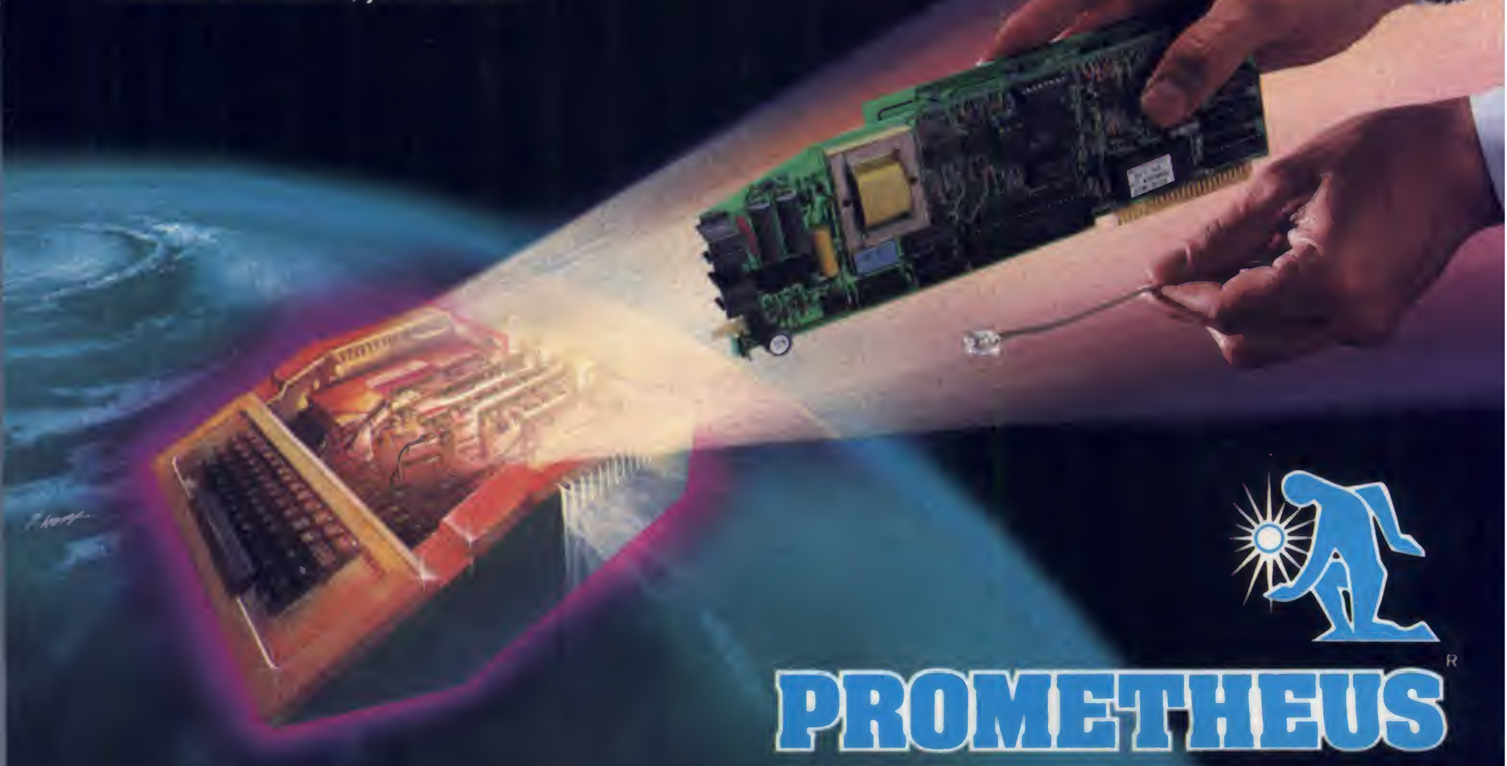

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CIRCLE 194 ON READER SERVICE CARD

A graduate of California State University Los Angeles with a Master's degree in accounting, David Gordon spent 13 years working as an accountant and controller for several large entertainment companies. He entered the software business as a hobbyist and, in 1978, founded Programma International, a major supplier of many of the programs for the first home computers.

In 1981, Gordon founded Datamost, Inc. and is the current president and CEO. Datamost has grown from the original four employees who occupied a single room in a private home to 75 employees who work in a 40,000-square-foot facility. In addition to software, Datamost started publishing books in 1981, and has published more than 30 titles to date.

think it is important to have a good time. The microcomputer industry has given me the opportunity to turn my hobby into my vocation. There are times when I have to pinch myself to believe that this is all really happening.

Microcomputers have been very, very good to many, many people. They have allowed us to create an industry and have a great deal of fun while doing so. Each and every successful microcomputer company has at its helm an entrepreneur/technician who had the ability and foresight to let his hobby become his livelihood.

The computer industry awakened a "sleeping giant" in me—my ability as a marketeer. I never knew I had that ability. I had relegated myself to being a pencil-pushing bean counter, but getting into the computer industry allowed my latent marketing ability to take over.

I realized that I had creative talents and natural inclinations about where the market was going. I jumped on the bandwagon and quickly became known as a maverick in the industry. Soon I learned that the marketeer in me would not allow me to do anything in a traditional manner. My reputation as a maverick grew.

I got my start in the computer book field by publishing a book that had been rejected by several publishing companies as being too "machine specific." That title turned out to be a best seller. Later I published a book that was rejected by the world's largest publisher as being too "age specific." That book is currently Datamost's best seller, and more than 300,000 copies have been printed to date in the resulting series.

Games were my first love. When I entered this industry I had an enormous library of computer game software. On one of my first trips to Apple Computer in 1978 I took with me a simple maze game called Escape by a fledgling company called Muse. Apple had 50 or 60 employees at the time and I created a work loss of approximately 60 man weeks because everyone at Apple was playing that game instead of working. They were charting out the mazes and trying to solve the puzzle. In the beginning the industry was made up of people who wanted to have a good time. Today people are still having fun, but the definition has changed.

Now it's 1984 and to be honest with you I haven't booted up my computer in one solid year. I am, however, still having just as much fun as ever. It's just that my definition of fun has changed. Instead of playing games, I play with the deals I make; instead of playing with a joystick, I am directing a company; instead of traveling through an adventure game, I travel the world; instead of ruling the world in Hammurabi, I rule a company. The computer industry has allowed me to do what I never dreamed was possible—to build a company that started out as my hobby and to make a valid contribution to the future of computing. ■

THE COMPUTER STORE SAGA/STAN VEIT

Stan Veit, editor-in-chief of Computer Shopper *magazine, opened the Computer Mart of New York, the first store that sold more than one brand of computer and the first computer store outside of California. He taught personal computer courses at The New School in New York City.*

He has written Getting Involved With Your Own Computer *with Leslie Solomon;* Using Microcomputers in Business; *and* The Peripherals Book. *He was computer editor of* Popular Electronics *magazine and became technical editor when that magazine changed its name to* Computers and Electronics.

Ten years ago when *Creative Computing* published its first issue, computers were minicomputers and mainframes. They were sold by factory salespeople or by companies called OEMs that put systems together and sometimes provided software to make them run.

In January of 1975 the MITS Altair microcomputer appeared as a construction project in *Popular Electronics* magazine. A few months later, Ed Roberts, president of MITS, and his crew took it on the road to demonstrate its capabilities to a skeptical world.

One of the first places the MITS caravan stopped was in Southern California where a young couple, Dick and Lois Heiser, attended the show. Dick saw the Altair as the key to a business of his own and soon obtained a dealership from Roberts.

Not long thereafter, he opened a storefront computer company in Los Angeles called Arrowhead Computers and began to sell all the Altairs he

could pry loose from the overburdened factory.

On the other coast, in December of 1975, an out of work technical writer decided to follow in Dick's footsteps. I begged and borrowed about $20,000 in starting capital from friends and family and opened the Computer Mart of New York in a few hundred square feet of space in Polk's hobby department store on Manhattan's famous Fifth Avenue.

Computer Mart was different from the Heisers' store because it sold more than one brand of computer. We opened as a dealer for Sphere, the first desktop computer, and Imsai, an 8080 computer that was functionally identical to the Altair.

One computer we did not sell was the Altair itself. Ed Roberts had granted the exclusive right to sell Altairs on the East Coast to The Computer Store, a company in Boston headed by Dick Brown. This situation turned out to be a blessing because, although Roberts believed that Altair dealers should sell only MITS products, his company could not produce enough machines to satisfy the demand.

Many new dealers, therefore, turned to the other S-100 company, and by the time of the first Atlantic City Computer Show in August 1976, Imsai was the leading manufacturer of personal computers. Ed Faber, who later founded ComputerLand, was the sales manager for Imsai at the time and offered a dealership to anyone who bought $2500 worth of Imsai hardware and promised to buy 25 additional computers that year. Under such liberal terms, computer stores began to proliferate. Many of them were basement or garage operations, and some, designed to allow a group of buyers to save money, existed only on paper.

Hand-to-Mouth Operations

The Computer Marts (by this time there were stores using this name in California, New Jersey, and New England, all independent but loosely allied) sold Imsai, Sphere, Southwest Technical Products, Polymorphic, and Processor Technology computers. The method of doing business then was very simple. The customer would come into the store for a demonstration. He (and 95% of them were men) needed a good understanding of computers, because the salesman only spoke computerese and only went through the demo once. If he decided to buy, the customer would leave at least 1/3 of the price as a deposit on the computer.

When the retailer had orders for five or ten machines, he would put up the balance of the wholesale price and order the computers from the manufacturer, paying in advance. When the manufacturer received the money, he would buy the parts and begin to put the product together. It was a hand-to-mouth business.

At first there were no factory assembled units, only kits. You had to understand electronic schematics and have a good eye and a light hand with the soldering iron to build a working computer. The instructions were minimal: "First solder in all resistors on the top of the board." "Check the schematic for correct values." "Be careful not to cause any solder bridges." "Run a jumper wire from Q4-Base to C43+." Even much later, when stores discovered that they could make more money by selling "factory assembled" computers, the machines were really kits put together by local hobbyists.

Magazines for the Mavens

One of the things that kept the computer retailers going was the sale of magazines. There were only a few personal computer magazines in the beginning, and they were sold only in computer stores. Almost everyone who came into the store left with a book or a magazine—usually several magazines.

Back then, there was no such thing as a back issue. People would buy any magazine they could get their hands on, regardless of the cover date, and certain favorite issues sold for many times their cover price. Hence, the birth of three volumes of *The Best of Creative Computing.*

Dave Ahl would sell his magazines anywhere there was a group of people with an interest in computing. He soon found that many of the same people who were interested in science fiction were also interested in computers, so he attended all the science fiction conventions in the New York-New Jersey area and sold his magazines.

Computer Mart of NY attracted a great deal of attention at the NY Personal & Small Business Computer Show, September 1978.

Whenever Dave came to a convention in New York, he would also deliver a batch of his latest issues to Computer Mart of New York. It was quite a sight to see Dave arriving for a convention dressed in jeans and a T-shirt advertising *Creative Computing* and carrying a bundle of magazines in each hand.

Computer Stores Proliferate

By the summer of 1976, there were quite a few new computer stores across the United States. The Computer Mart name was being used by John French in Los Angeles, Charles Dunning in Waltham, MA, and Larry Stein in Islin, NJ, and Computer Marts were due to open in Vermont and New Hampshire.

The first company to link the words "personal computer" was a store in Fraser, PA. This early retailer sold a system consisting of Digital Group computer boards in a fancy wooden cabinet as the Personal Computer, thereby christening a new

generation of hardware.

Dick Brown's Computer Store was flourishing in Boston and had a branch in New York City. Byte'tronics in Knoxville, TN, and the Computer Systemcenter in Atlanta were two Altair dealers that grew into much larger businesses. Byte'tronics became Seal Electronics, a manufacturer of memory boards and computers, and the Computer Systemscenter was the foundation of what later became Peachtree Software.

In the Washington, DC area, the Computer Workshop of Rockland, MD was introducing little computers to Federal Government agencies, and down in Florida, we saw Sunny Computer Stores in Miami and Microsystems in Tampa.

The Micro Store of Richardson was the only computer store in Texas until Radio Shack opened a retail computer store in Fort Worth. And in the midwest, Data Domain of Bloomington, IN, was the forerunner of many stores in that region, including one called itty bitty machine company in Chicago.

Back on the West Coast, Paul Terrell had started his Byte Shops in the Bay Area, and this franchise was spreading like McDonalds down into Silicon Valley. By the summer of 1976, there were more computer stores in the San Francisco area than in the entire rest of the world combined.

No Pot of Gold

Very few of these pioneer retailers survived the first decade of personal computing. Many were undercapitalized and, like the manufacturers from whom they bought, they were often caught in a cash flow squeeze when models changed and products became obsolete. The demise of suppliers like Processor Technology and Imsai spelled doom for many of their dealers.

A few of the early retailers have survived by going public to raise money for expansion. Computer Factory of New York City and Prodigy Systems (formerly Computer Mart of New Jersey) are two examples.

The success of franchises like ComputerLand has provided retail outlets for many computer manufacturers, but the business is not the pot of gold that the pioneers envisioned. Even such giants as Texas Instruments, Xerox, and Digital Equipment have failed to find profitability in the retail computer store business. IBM and Sears will do well as long as they can continue to sell IBM PCs in a seller's market, but it remains to be seen how well their stores will do if the Japanese invade the industry and the market becomes truly competitive.

The history of electronic equipment marketing is a well marked path, with the entrance being high tech specialty stores owned by small companies. The path then leads through multi-store chains and larger retailers. Finally, it spreads to many branches, including mass marketers, mail order sellers, discount stores, specialty stores, catalog stores, direct sales, and every other form of retailing. And as distribution moves down this path, the percentage of profit diminishes, as does the amount of service offered to the consumer. There is no reason to suspect that things will be any different for personal computers. ■

YOU WANT TO OPEN A WHAT?/DAVID AND ANNIE FOX

It all began in August of 1976 during one of our frequent lapses of sanity. That was the time we dreamed up the idea of opening a community computer center. In today's world of bytes, frame buffers, and miniscule-microscopic-floppies, starting a computer center might not seem like such a revolutionary notion. But in that day and age when the only way someone could get his hands on a computer was by going to MIT, it really was something. When we presented our brainstorm to our friends and family, they were unanimously baffled by our choice of endeavor. "What in the world do *you* know about computers?" they asked with as much skepticism as they could muster. To which we replied, "Nothing . . . yet, but neither does anyone else!"

After a year of falling asleep on page 2 of every computer book we tried to study and cursing our borrowed teletypewriter until all hours of the morning, we finally finagled a bank loan that would put us in debt for the next five years. Then we were ready to open the world's first microcomputer center. Ready except for one small detail; we couldn't decide which computer to buy. And even back then, when there were relatively few choices, picking "the right system" was a problem. David spent six months collecting brochures on every one manufactured within a 25,000-mile radius, and when it finally came down to the ultimate decision, we purchased ten Processor Technology Sol-20s. Why? Because they were blue.

The Grand Opening

Then, computers in place, we opened our doors, and 700 screaming people (kids because they were excited and adults because they were petrified) rushed in to play the most advanced games available this side of the Pentagon. And what did we have waiting for them?

Well, there was a *Robot Chase*, which we entered byte by byte from an issue of *Dr. Dobb's Journal* with the help of a magnifying glass. Now *there* was a graphic adventure: a bunch of X's chasing an O in living black and white. And, if you placed an AM radio next to the computer and tuned it in between stations, you were rewarded with a cacophony of buzzes and beeps to accompany your game play.

Then there was *Trek-80* which presented all kinds of challenges, the first of which was to get the damn thing loaded successfully from the cassette. Then, when the game was finally in the machine, it moved so fast that nobody could learn how to play it.

And let's not forget the ever popular, *Guess My Number* in which the computer actually called you by your *first name* (heaven helps those who insisted on typing in their last names too).

Those were the days when people would walk into our center in San Rafael, stare stupidly at the Sols lining the walls and exclaim, "I thought this was a *computer* center. Where is *The Computer*?" What did they think those

Annie Fox, along with her husband, David, co-founded the world's first public access microcomputer center. Since its opening in 1977, Marin Computer Center has served as a prototype for bringing today's technology to the public. At the center, Annie was responsible for teaching all the programming classes for children and adults. Her popular book, Armchair Basic, *illustrates her unique approach to opening the world of computers to "non-technical" people. These days Annie devotes her time to fiction writing (on a word processor, of course) and is working on her second novel.*

David Fox has been a member of the Computer Games Project at Lucasfilm Ltd. since 1982 and was the project leader for one of their first games, Rescue on Fractalus!. *He is the co-author of* Pascal Primer, Armchair Basic, *and* Computer Animation Primer *as well as the software package* Apple Spice. *When not playing with computers, David enjoys science fiction, good films, photography, and biking with Annie and their daughter, Jessica.*

things were, blue typewriters. Weren't they large enough to qualify as *real* computers? Those "micros" weighed in at 44 pounds apiece, not to mention the 30-pound monitors we had to lug around with them when we went out to schools to spread the word. Oh the biceps we developed!

Even when we weren't bench pressing the computers, the technology was somewhat difficult to work with in the days before everyone used floppy-disks. We had to contend with onery tape recorders that routinely ate tapes and onery computers that consistently refused to talk to the tape recorders when the cables were plugged into the wrong holes. When we finally got a program from the recorder into the computer, either there wasn't enough memory to play the game or the customer changed his mind about wanting *Hangman* after all.

Then there were the customers who asked, "How long will it take for this game to load?" "Somewhere between four and five minutes," we'd reply. Using one of those new digital watches, they'd stop the recorder when 4 minutes and 30.0 seconds had elapsed and then demand to know why the game didn't work.

When everything was working though, it was pretty easy to wow people with computers then. Running a little program like:

```
10 INPUT "What is your
   name?" N$
20 PRINT "Nice to meet
   you,"; N$
```

was enough to knock anyone's socks off. Today's kids are different. With all the mileage they rack up in the arcades, they have become a pretty jaded group. But during our first couple of years only one or two kids out of every visiting school group had even touched a computer.

Great Expectations

Despite (or because of) their total ignorance, people expected miraculous things from computers back then, figuring them to be a cross between the Library of Congress and a crystal ball. We were constantly hearing complaints like, "Can't it even tell me my birthday?" and "How come it doesn't know the capital of Venezuela?" One man searched in vain for a slot in the back of a Sol large enough to accept copies of both an English and a Russian dictionary, figuring the computer would then be able to do instant translations for him. A woman took our beginning programming class had typed the word EDIT on line 1 of her non-functional program before she saved it on cassette overnight. When she came back the next morning, she was distraught to find that the program still didn't run. "How come my program dosen't work?" she said, wringing her hands in dismay, "I told it to EDIT!"

> *People expected miraculous things from computers back then, figuring them to be a cross between the Library of Congress and a crystall ball.*

Have we mentioned yet how much fun it all was back at the dawn of microcomputers? It was a double density pleasure that we wouldn't have traded for anything. ■

THEY DON'T MAKE COMPUTER MAGS LIKE THEY USED TO/

TOM DWYER

Portrait of the author lamenting the passing of 'the good old days' in computer magazine publishing. The protrait abstraction was done by Margot Critchfield, using KBMOUSE.

Tom Dwyer is professor of computer science at the University of Pittsburgh. He was director at Project SOLO in the early 1970's, an innovative project to develop interactive learning materials. Since then, he has written (with Margot Critchfield) a dozen or so books on personal computing including Basic and the Personal Computer *and* So You Just Bought a What?

Ah, for the good old days—tomatoes grown from real seeds, cigars rolled from real tobacco, beer made by real brewers. And of course real computer magazines, magazines good enough to read and small enough to lift.

Nostalgia notwithstanding, there actually *was* a time when all the computer magazines had personality. Having them show up in your living room was like having the editors themselves drop in to express their sometimes controversial, but always fascinating, points of view.

There was, for example, the thin version of *Byte* with its genius for forging new frontiers as masterminded by Carl Helmers. Across town there was a rival mag called *Kilobaud* run by Wayne Green, a fellow who delighted his readers by taking on IBM, Tandy, and AT&T (or any other corporate gaint) each and every month. And of course, there was Dave Ahl's *Creative Computing,* never afraid to engage in a little leg pulling. In fact it was sometimes difficult to tell its infamous April 1 extravaganza from the "normal" issue.

Where are they now? How did (in the words of Minnie Floppy) "the frontal lobotomy crowd" get to take over? What brought on the avalanche of nothingness now found nestled in the folds of the dozen of slick newcomers that look as though they were all produced by a conglomerate called Puerile Press? And where the devil is Minnie?

One answer is that times have changed, and there's a new publishing need today, one "attuned" to a new readership. Another answer is that computer magazines are now big business, and the rash of instant imitators flooding the newstands is to be expected, especially when the dollar stakes involved are considered.

Preserving Our Integrity

So much for the bad news. The good new is that in more than one case the style and flair of the early days of computer magazine publishing are alive and well. There is still plenty of distinctive "we'll do it our way" personality in oldies like *Dr. Dobb's Journal* and *Creative Computing.* There are also several middle-aged magazines (*Microsystems and Compute!*) that have preserved their integrity. The proof is in the continued value of their back issues. This has held up consistently over the years and is just as high for recent volumes.

As an example, the March 1984 issue of *Creative* contained 12 articles that gave "inside looks" at computer companies. These articles will undoubtedly make valuable source material when the history of this decade of computing is written. The articles were done with a professionalism and candor that is refreshing—especially when you consider the pressure on

KB MOUSE program listing.

```
100 '*******************************************************
110 '*     KBMOUSE.BAS   (A KEYBOARD 'MOUSE' FOR THE IBM PC)   *
120 '*      REPRINTED WITH PERSMISSION OF ADDISON WESLEY CO.   *
130 '*      FROM   "A BIT OF IBM BASIC AND BASICA"  (1984)     *
140 '*******************************************************
150 ON ERROR GOTO 730
160 CLS: SCREEN 1: COLOR 0,0: DIM CUR%(14)
170 LINE(158,98)-(162,102),2: LINE(158,102)-(162,98),2
180 GET(158,98)-(162,102),CUR%         'SAVE CURSOR IN CUR%
190 PRINT">>> USE THE NUMBER PAD TO DRAW <<<"
200 INPUT">>> PRESS <NUM LOCK>, THEN PRESS <ENTER>";DUM$
210 CLS: KEY OFF: LOCATE 25,1
220 PRINT"5=PEN UP/DOWN    B=BRUSH    C=COLOR";
230 T=9999: F=1: P=1: C=3: S=0: COLR=3
240 X=160: Y=100: PSET(X,Y)          'START IN MIDDLE OF SCREEN
250 '=======================================================
260 '                    START MAIN LOOP
270 '
280 X$=INKEY$ : D=VAL(X$)
290   IF X$=""THEN PUT(X-2,Y-2),CUR%: PUT(X-2,Y-2),CUR%:GOTO 530
300   IF X$="B" THEN GOSUB 590          'BRUSH SELECTION ROUTINE
310   IF X$="C" THEN GOSUB 650          'COLOR SELECTION ROUTINE
320   ON D GOTO 340, 350, 360, 370, 380, 390, 400, 410, 420
330   GOTO 280
340   DX=-1: DY=1: GOTO 430             'NUM PAD 1 = SOUTHWEST
350   DX=0: DY=1: GOTO 430              'NUM PAD 2 = SOUTH
360   DX=1: DY=1: GOTO 430              'NUM PAD 3 = SOUTHEAST
370   DX=-1: DY=0: GOTO 430             'NUM PAD 4 = WEST
380   DX=0: DY=0: F=F*-1: GOTO 450      'NUM PAD 5 = PEN UP/DOWN
390   DX=1: DY=0: GOTO 430              'NUM PAD 6 = EAST
400   DX=-1: DY=-1: GOTO 430            'NUM PAD 7 = NORTHWEST
410   DX=0: DY=-1: GOTO 430             'NUM PAD 8 = NORTH
420   DX=1: DY=-1: GOTO 430             'NUM PAD 9 = NORTHEAST
430   X=X+DX:Y=Y+DY
440   IF X<0 OR X>313 OR Y<0 OR Y>193 THEN 530
450   PUT(X-2,Y-2),CUR%: PUT(X-2,Y-2),CUR%
460   IF F=-1 THEN 530
470 '----- DRAW ONE POINT OR MANY POINTS -----
480   IF S=0 THEN PSET(X,Y),COLR: GOTO 530
490   PSET(X+S*RND,Y-S*RND),COLR
500   PSET(X-S*RND,Y+S*RND),COLR
510   PSET(X-S*RND,Y-S*RND),COLR
520   PSET(X+S*RND,Y+S*RND),COLR
530   T=T-1: LOCATE 1,1: PRINT"TIME LEFT:"T
540 GOTO 280
550 '
560 '                         END MAIN LOOP
570 '=========================================================
580 ' -----------     BRUSH & COLOR SUBROUTINE      -----------
590 LOCATE 25,1: PRINT"L)ARGE  M)EDIUM  S)MALL                ";
600 Y$=INKEY$: IF Y$="" THEN 600
610 IF Y$="L" THEN S=10
620 IF Y$="M" THEN S=5
630 IF Y$="S" THEN S=0
640 GOTO 710
650 LOCATE 25,1: PRINT"G=GREEN  R=RED  Y=YELLOW  E=ERASE (BLK)";
660 Y$=INKEY$: IF Y$="" THEN 660
670 IF Y$="R" THEN COLR=2
680 IF Y$="G" THEN COLR=1
690 IF Y$="Y" THEN COLR=3
700 IF Y$="E" THEN COLR=0
710 LOCATE 25,1:PRINT"5=PEN UP/DOWN    B=BRUSH    C=COLOR    ";
720 RETURN
730 LOCATE 1,1:PRINT"!! OFF SCREEN !!";:RESUME 300
```

computer magazines to not risk offending their advertisers.

The ultimate test of a computer magazine, however, is in its technical content. And with all due respect to professional writers, the real gems in computer magazines have come from amateur contributors.

Such material can be particularly valuable to teachers and students (which, of course, includes all of us). For example, there was an article in the February 1984 issue of *Creative* by Kimball Rudeen called "Curve Design." I told my class in Computer Graphics about it, and we implemented versions of Kimball's Blended Parabola program for both the IBM PC and the Zenith Z100. (Incidentally, the Z100 is really a super color graphics system). For our purpose, this article was the nicest thing to come along since malted barley.

Do Something Creative

But there's more. I then gave the following assignment: "Do something creative." "What does that mean?" they asked. "Well," I replied, "how about designing an interactive version of Kimball's program that integrates his blended parabola algorithm with the color-keyboard-mouse utility I gave you last week"

This utility (KBMouse) is basically a computerized etch-a-sketch program that allows use of different colors and paint brushes (including a spray can à la Lisa and Macintosh). The students' results with this assignment have been quite impressive. *Creative Computing* lived up to its name once again, helping a few dozen undergraduates at one university understand a little bit more about creative-versus-textbook learning.

For those of you who would like to try your hand at this same assignment and in the spirit of never ending a computer magazine article without contributing at least *one* useful idea, a listing of KBMouse for an IBM PC with the color graphics adapter appears on page 140. The program can be used as is or modified to become an interactive input module in another program (like Blended Parabola). Incidentally, the version we used on the Z100 is both simpler and better. Neither the SCREEN command nor the NUM LOCK hassle are needed; screen resolution is higher; and all eight colors are available. Even better results are possible on the Tandy 2000. ■

TWO YEARS BEHIND THE MASTHEAD/DAVID LUBAR

David Lubar is 30 years old and writes things. Some of the things are computer programs. Some of the things are articles. The thing here is supposed to be an article, but you may feel free to turn it into a program.

He has been married for seven years, which, he says, is against the law in California, but he and his wife Joelle plan to flout tradition and stay together. Lubar's first real job was with Creative Computing. *His current real job is with Activision. His latest game is* Pastfinder. *He asks that you please buy it and get one for a friend.*

Running into your ex-boss can be difficult. Especially if your ex-boss is David Ahl and you're trying to run into him at a computer show. He was always there, but hard to find—a rumor at Applefest, a shadow at CES. We finally met up at the West Coast Computer Faire. After chatting a bit and exchanging cat pictures, he mentioned that *Creative* was on the verge of a tenth anniversary. The occasion would be marked with a special issue including articles by those who had written for *Creative* in the past. As usual, the boss put no restrictions on contents.

This lack of restrictions can make life tough. If the boss had said "How about a short piece on the philosophical implications of the IBM keyboard," or "Could you write one of those useless little machine language programs for us," I would have had no problem. But I was on my own and wanted to do something worthy of the occasion. Everything I considered seemed either too shallow or too specialized. What follows is a compromise; a mosaic of scenes, impressions, anecdotes, and memories. To give some order to it, and to blatantly capitalize on the current popularity of books of lists, records, and trivia, I welcome you to the *Creative Computing* Awards, Records, Lists, and Other Stuff.

Worst Advice Given to an Associate Editor Attending His First Computer Show

The hotel is just a short walk from the train station. You won't need a taxi.

Article that by Itself Justifies the Existence of the Magazine

"Tero's Apple" was a father's story of how he modified a computer for his handicapped son. It inspired the first Computers and the Handicapped issue.

Three Games that Kept Us from Getting Any Work Done in Editorial.

• *Castle Wolfenstein.* (Andy made general. The rest of us kept blowing up chests full of grenades.)

• TI 99/4 *Soccer.* (Had this game not existed, the magazine could easily have been published weekly.)

• *David's Midnight Magic.* (Sub award to Peter Fee for best body english displayed during play of a computer game. It's all in the wrists.)

Most Controversial Article

"Don't Write that Program" by Steve Kimmel. This essay on the pointless side of using a computer for small tasks was met with a large, mixed response and inspired an article called (surprise, surprise) "Write that Program." Steve has a knack for controversy.

Best Caption for a Letter in Input/Output

Following an article on stock market predictions, a writer informed us that there was also a large school of people called "chartists," who used other methods for stock analysis. The letter was captioned "Pardon Me Boys, is that the Chart that Knew the Future?"

GOOD THINGS COME IN SMALL PACKAGES.

Surge protection for your computer has been proven to be a necessity—rather than an accessory*. But what about the rest of your household? The same micro processor technology which gave us computers is present in your microwave oven, TV, VCR, stereo system and those new fangled appliances that talk to you. This means that the same power surges, spikes and glitches that can destroy your computer can wreak havoc throughout the rest of your household.

We're EPD, the leader in electronic protection devices who brought you The LEMON™. Now we've packed our technological knowhow into The KIWI™. It simply plugs into an outlet and your appliance plugs into it, and its two LED lights give you a quick visual check that your KIWI is providing constant protection.

The KIWI . . . it's a small wonder and is ripe for the picking at your local computer dealer.

Studies by a major microcomputer insurance company show power surges rank second, only to theft, among reasons for computer loss.

DON'T PLUG IN WITHOUT US

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Electronic Protection Devices Inc.
P.O. Box 673, Waltham, MA 02254
(617) 890-2518 • 1-800-343-1813

CIRCLE 241 ON READER SERVICE CARD

Best Christmas Gift from a Publisher

One year we each got to take home one of the toys that had been reviewed for the December issue. (Note that the next year we got a chance to purchase leftover cheese from a press party at a discount rate, so things have a way of balancing out).

The Best Issues Ever

First honors have to go to the mammoth April Fools issue of 1980. It is a classic and timeless parody. For creative layout, honors go to the October 1980 Smalltalk issue.

Most Memorable Person

Ted Nelson. With all the current publicity about software windows, it is only fair to mention that Ted has been preaching this concept for years. He also invented the concept of word processing, though no one thought it was feasible at the time. Always on the fringe of the field, Ted seems to get there before the rest of us. And every time we reach him, he moves on.

Little Known Facts about the Magazine

Each month's Apple Cart is the previous month's Outpost: Atari with the word ANTIC changed to "lookup table."

David Ahl disappeared three years ago, leaving in his place a PDP-11 programmed to handle all the publishing tasks. Aside from occasional post cards from Bora Bora, he hasn't been heard from since.

Betsy Staples has been moonlighting for years as an essayist, writing under the name of Fran Leibowitz and sending her profits to a special fund for removing all punk rockers from Britain.

Once a year, an ad is run with the encrypted message "The walrus is Paul." The first reader to spot and decode the message wins a free Windjammer cruise to Montana.

All programs over five pages long are actually the same, except for the title and remarks. So far, no one has noticed.

I discovered early on that the easiest way to do a review was to write it first, then look for a piece of software that fit the description. If anyone has a game in which the player throws boomerangs at attacking teddy bears, there's a dandy write-up for it in the files.

Those missing lines in program listings are intentional. This is done as both a puzzle and an educational service.

Predictions for the Future

Ken Uston will publish his strategy for beating *VisiCalc* and be banned from accounting offices on the West Coast.

In honor of the new decade, Peter Fee will write his second article.

Steve Kimmel's article "Don't Buy that Computer" will pass unnoticed.

Wayne Green will lead a commando raid, attempting to take over Hanover Avenue. However, the initial coverage will leave him gasping for breath, and his horde of followers will be easily distracted by the hardware manuals scattered in their path.

Ted Nelson will invent something only three years ahead of its time instead of the usual 10 or 20. It will probably be something of an organic nature.

Best Freelancer

Glenn Hart. Glenn has a knack for making sense out of complicated topics. Besides that he's a great guy and used to be a professional musician.

Best Father Figure a Magazine Ever Had

Ron Antonaccio, who oversees shipping, won all our hearts by providing lunch at a reasonable price, as well as munchies and breakfast treats. Besides, his wife makes the best baked beans in the world, and Ron is always willing to take on extra tasks like running the Super Bowl pool.

Worst Piece of Equipment

The word processor in editorial while I was there was a hand-wired Altair with other vintage attachments such as a Solid State Music video board and an ASR-33 Teletype running at a staggering speed of 15 characters per second. The system still works, though no one knows why.

Three Non-Computer Games that Caused Much Wasted Time in Editorial

• Nerf basketball. Andy has the height advantage, but a body tackle usually equalized things.

• Darts. When the gang got tired of the game, the board could also be used as a polling device. This was done by placing a person's picture there, waiting 24 hours, then counting the holes.

• Names. This is played by writing the alphabet on a piece of paper. You then choose a random sentence. Write one letter of the sentence next to each letter of the alphabet. Players have five minutes to find famous people whose initials match each letter pair. If the boss comes in, pretend you're compiling a list of future contributing editors. For complete rules, and a list of upcoming tournaments, contact Peter Fee.

Nice Guy Award for a Journalist Not Associated with the Magazine

Steve Levy, a writer for *Rolling Stone*, started doing a few articles about the computer world several years ago. He just finished a book on hackers and is one of the few people around who has managed to cover the scene from the outside (though he moves more to the inside every day) without sensationalizing things or hyping what he sees.

A Serious Prediction

With processor speeds increasing and memory getting cheaper, the fine art of good programming will vanish. Elegant code will become a rare item practiced by a few diehards. Since there will be no external evidence of this, no one will notice.

The Lemon Law

A positive review will evoke little response from readers. A negative review will be met with scads of angry letters from people insisting they got their money's worth.

Untrue Rumors and Other Lies

We never played Frisbee with the ZX-80. True, we did use it as a doorstop on occasion, but never as a flying toy.

Editorial loves getting phone calls, the more the better.

There are not ten thousand copies of *Space Invader* tapes for the Exidy Sorcerer in the warehouse. Five thousand is a more realistic guess.

A Fun Joke to Play at a Computer Show

In the old days, booths at computer shows were staffed by hackers, hobbyists, and entrepreneurs. Recently, as more and more companies are acquired by large corporations, the

booths have been taken over by people in suits (perhaps from corporate sales forces, perhaps from Mars. Who knows). Anyhow, the next time you're at a computer show, go up to one of these booths and ask something ridiculous such as, "Say, which back issue had that article on turning your Selectric into a modem?" or "Are your program listings more easily converted to Algol or ASCII?" It's great fun and will keep them busy for hours.

Eight Good Reasons to Own a Computer

1. It makes balancing your checkbook easy since there is nothing left to balance.
2. It is a great toy.
3. You can use it to make a billion dollars at home in your spare time. Or go bankrupt.
4. It is a really neat toy.
5. It is a tax write-off.
6. If you hate your neighbors, you can use your computer to destroy their TV reception. This works even if you like your neighbors.
7. Everyone else has one.
8. It is a fantastic toy.

An Introduction to Programmer Language

The following translations are presented as a public service for the spouses, siblings, and parents of programmers. When a programmer is searching for that last bug and says, "I'll be done in five minutes," he means, "See you sometime next week."

"It's a really useful peripheral and it only costs $800 means "It's a neat toy."

"I can write a short program to handle your records," translates into "See you in a month."

It's Not All Glamour

No job is perfect. Following are a few incidents into which reality intruded.

One of my first assignments was covering a videodisc conference in Arlington. From there, I had to go to a computer show in Philadelphia. The Arlington part was fine, but I reached Philadephia, tired and ready to sack out, just in time to find my hotel room was being used for the *Creative Computing* press party.

My second day on the job, I got to search through ten bags of garbage for some missing manuscripts. It later turned out the manuscripts weren't missing, but I can recommend such an exercise for anyone who needs a humbling and rather messy experience.

In the early days, before we moved to larger headquarters, the magazine was run from a small duplex. My office was a stairwell. I would have killed for a spot in the hallway or kitchen, but fate was not that kind.

On the Other Hand

There were also a lot of fantastic moments. Here are a few that stand out in my mind.

I got to tour the New York Institute of Technology and see some of the most advanced computer graphics in the world.

The job brought me in contact with some of the most creative, and nicest, people in the field, including Mark Pelczarski, Bob Bishop, Doug Carlston, and others too numerous to mention.

I got to play scads of computer games and pretend it was work.

And a Final Moment of Mush

I really do value the time I spent working for *Creative Computing.* It was a great experience and a chance to get to know some fine people. A lot of innovation went on there, and a lot more will come. Dave and Betsy always gave writers free rein to write whatever they wanted. This is a rare thing in the publishing world and an attitude that has helped keep the magazine on the leading edge. We've all gained a lot from this. Congratulations on the first decade, and thanks for letting me share in the madness. ■

THE ROLE OF MAGAZINES IN PERSONAL COMPUTING/ DAVID BUNNELL

At 36, David Bunnell is young enough to have spent most of his working life in the personal computer field. In the early 70's, Bunnell joined MITS, Inc., and was responsible for marketing and advertising the Altair. Two years later he left and served as publisher of Personal Computing.

In August, 1981, IBM announced its entry into the personal computer market, and by the time IBM had packed and sealed its first shipment in October, Bunnell had revealed his plan to publish PC: The Independent Guide to IBM Personal Computers, *a magazine devoted exclusively to the IBM PC. In November 1982 when* PC *magazine was sold to Ziff-Davis Publishing Company and moved to New York, Bunnell launched a new magazine—*PC World*—the personal computer magazine for second-generation IBM PCs and compatibles.*

This being the tenth anniversary of *Creative Computing*, the first personal computer magazine, personal computer magazines seem an appropriate topic. The past ten years have taken *Creative Computing* from being a unique publication to being one of more than 200 such publications. Today these magazines range from general publications, such as *Personal Computing* and *Microcomputing*, to specialized, machine-specific magazines, such as *80-Micro* for Radio Shack computers and *PC Magazine* for IBM personal computers. Other magazines are aimed at specific aspects of personal computing such as retailing (*Computer Retailing* and *Computer Dealer*), programming (*Lifelines*), and software buying (*List*).

If You Can't Make Money With Computers, You Just Haven't Tried!

BY NICK LAURIELLO

In the last five years, over 1 billion computers were sold in the United States. Computer companies are gearing up to produce another 10 billion computer devices in the next five years Forecasters are now predicting a 1000% increase in the number of personal computers in use by 1990.

While most of the fanfare is being centered around the computer manufacturer's battle for supremacy (some winning, some losing), what is going unnoticed by the general public is the billions of dollars being made by the many smaller computer support enterprises. These spin-off operations are under intense pressure to support the computer industry with software, supplies, peripherals, accessories, parts, information, education, and many other services.

A spin-off business often can be entered without any technical computer knowledge, but with just a little business sense.

Not so long ago I was asked to write an article for a computer magazine on "How to get your ideas into production". As a consultant in the electronics industry and President of Super Circuits Inc., (a manufacturer of Printed Circuit Boards for the electronics industry during the last 15 years), I helped many companies package and produce computer - related devices and software. Some were firms with new ideas and some with not so new (borrowed) ideas.

I wrote an article on what to do with these ideas. In addition, what to do if you lack original ideas was included.

The article was rejected by the magazine. Why? Because it was too critical of some advertisers. It explained how many of these advertisers operated. The article contained too much "inside" information on how you can start a business with borrowed ideas as many of those advertisers themselves did.

But all was not lost! I expanded the article into a full study of business opportunities in the computer industry. It was bound into a book about what people are doing to make money in this industry.

If you've been waiting for the next big boom to get in on the ground floor of a growth industry, that boom is happening now and the industry is "computers". There's money to be made in computers, lots of it. But don't think about manufacturing computers. The stakes are too high for the small businessman. Instead, look to the spin-off enterprises. That's where you'll find thousands of opportunities available to those who know how to find them.

You've probably seen some of these opportunities, or had ideas of your own, but just didn't know how to capitalize on them. Perhaps all you need is a guided tour through the industry, with facts and figures, to understand how the industry works and how easy it is for an individual to start a computer-related business and grow with the industry.

In this book I have analyzed hundreds of business opportunities, providing guidelines that tell what to look for and what the potential market is before investing in any of them.

This book explains how some people are making money, with no computer or very little business experience. They are filling a need or performing a service that was created by the growth of the industry itself. Emphasis is placed on businesses that can be started part-time and with little capital investment that have the potential of developing into large profitable enterprises.

Some of the topics covered are.... Sales and Distribution; Retail Stores; Wholesalers; Discount Outlets; Franchises; Systems Houses; Vertical Markets; Part-time Businesses; Mail Order Sales; Computer Services; Software Markets; Writing Programs; Contract Work; Freelancing; Games, Utilities, and Educational Software; Selling to Publishers; Publishers Looking for Freelance Programs; Publishing Software; Copyrights; Advertising; Direct Mail; Magazine Advertising; Writing; Manufacturing; Peripherals; Accessories; Packaging; Service Centers; Database Centers; The Educational Market; Supplies; Computer Control; Future Trends; Developing Ideas; Creative Thought; and more.

This book is must reading for anyone thinking about starting a computer-related business.

For the experienced business person, it's a valuable reference guide with lists of computer manufacturers, software publishers, distributors, franchises, facts and figures about what the competition is doing. It contains more then 250 pages of valuable information on who is making money with computers, which businesses are open to competition, which are already saturated, and which are predicted to be money makers.

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The nature of personal computers explains the existence of such a diverse collection of magazines. Unlike many of the great technological inventions preceding it, the personal computer acts as an extension of the mind. As such, the personal computer is immensely diversified and in many ways immensely complicated. Every aspect of personal computing, from buying to selling to programming, involves an incredible amount of decision making. The amazing array of personal computers, programs, and optional products emphasizes this fact.

No matter how you are involved with the personal computer, you need lots of information. Gathering this information is often difficult because the personal computer is still young and is evolving so rapidly that the available information is in constant flux. Today's state-of-the-art spreadsheet is tomorrow's has-been.

Creative Computing, the first and longest lived personal computer magazine and its founder, David Ahl, deserve tremendous applause. Not all personal computing magazines have been such great successes. Over the years I have watched many of them rise and fall.

One of those that tried and failed was a personal computing magazine called *ROM* published by Erik Sandberg-Diment, now a well-read columnist for the *New York Times*. ROM came out only nine times before it bit the dust. Other titles no longer with us include *Microtrek* and *Desktop Computing*.

Solid Background

As the founding publisher of four of the more successful ones (*Personal Computing, PC Magazine, PC World* and *Macworld*), I like to think I know some of the reasons why some personal computer magazines make it so big while others fail. First and foremost, like magazines in other fields, a personal computer magazine must be well conceived. *Creative Computing* is based on the solid idea that many people who use personal computers want to use them creatively. David Ahl, who drew his early computer experience from minicomputers, knew that playing games on computers was not only fun but educational. He also realized that conceiving and writing new games was challenging and entertaining. He created a magazine designed as an information vehicle for people who like to learn by being creative and having fun with their personal computers.

Carl Helmers, who created the idea for *Byte* magazine, had a different idea. More fascinated with the technology of computers than with their applications, Carl believed that many people would want to learn about computer technology and actually participate in the development of the personal computer. He guessed right, and *Byte* became one of the all-time great publishing success stories.

Both David Ahl and Carl Helmers created magazines that they would like to read. Basically, David's magazine was a software magazine and Carl's, a hardware one. Their motives had little to do with building publishing empires or making megabucks. They simply knew that there were a lot of people who needed a magazine to help them actively pursue their passions for computing.

In 1976 I came up with the idea for *Personal Computing*. I was influenced by both David's and Carl's creations, but I sensed a need for a magazine for people who were neither fascinated by computer technology nor interested in becoming as involved with their personal computers as the readers of *Creative Computing*. I thought there should be a magazine that was oriented toward people who wanted to use a personal computer as a productivity tool without knowing too much about how personal computers work or are programmed—this magazine would be the first consumer-oriented personal computer magazine. As a person who had no computer or technical background but who found the concept of personal computers fascinating, I created the magazine I wanted to read.

Fortunately I met a fellow with even less enthusiasm for computer technology than myself who was also one heck of a good writer, Nels Winkless. His contribution to my idea about *Personal Computing* was that this magazine should be less about computers and more about the people using them. Nels agreed to serve as editor, I played the role of publisher, and the magazine was born. Today neither of us is involved with *Personal Computing* but we are both proud of the fact that it is one of the most read of the personal computer magazines. Had *Personal Computing, Creative Computing* and *Byte* not been well conceived in the first place, none of them would be around today.

Fiscal Strength

Having the right idea at the right time is always useful; however, other factors also have helped make the above three magazines the phenomenal successes they are today. While all three of them were started on a shoestring by a small group of individuals or by small publishing companies, their transition into big-time publishing was accomplished with the helping hand of big-time publishers. Once a start-up magazine has reached a certain point, it needs financial backing and publishing expertise to continue to grow and prosper. Today *Personal Computing* is published by Hayden Publishing, *Byte* by McGraw-Hill and *Creative Computing* by Ziff-Davis.

The market for personal computing magazines is new and different from the market for other magazines. Computer stores provide a natural outlet for personal computer publications—a far better outlet than newsstands. Far fewer magazines are returned from computer store shelves than from newsstands. Not many people realize this, but more than half of the personal computer magazines put on newsstands are thrown away. Not only is this a waste of trees, but it puts a financial burden on publishers. With-

development."

George Blank, *Creative Computing*, July, 1984

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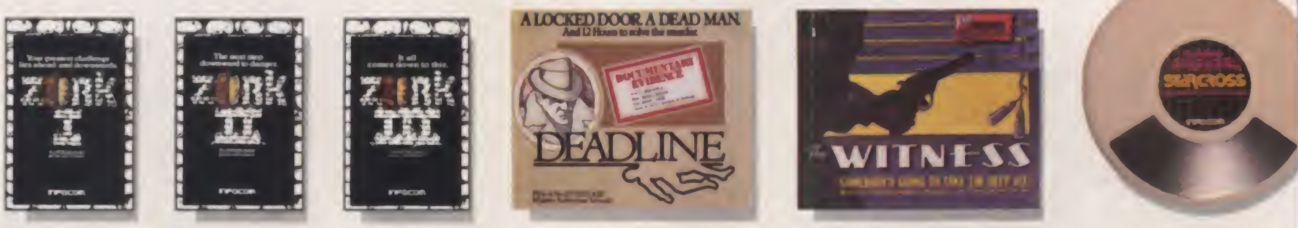
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out computer stores, David Ahl, Carl Helmers, and I would have faced an almost impossible task in getting our magazines distributed at a price we could afford. Also, the three of us benefitted from the fact that the number of personal computers has been doubling or tripling year after year—there are always new readers and new advertisers.

The incredible amount of advertising in personal computer magazines is a testimony to the vitality of our industry. I have often talked to publishers of other types of magazines who drool with envy when they consider the ad pages in personal computer magazines. This unprecedented volume reflects the entrepreneurial spirit in our country and the political and social environment that allows personal computing to prosper, uninhibited by government regulations.

Eventually all magazines, even computer magazines, must play by the rules. These rules identify three major revenue streams—subscription, single-copy, and advertising revenue. These are intertwined in a triple helix that represents the science of magazine publishing. Single-copy sales directly affect the subscription rate, which in turn affects the amount of advertising you get. It is a delicate balance, the nuances of which have produced a library of literature.

We personal computer magazine publishers like to think that it is our sincere interest and our unique knowledge of personal computing that make us successful. *Creative Computing* could never have been such a smashing success without the insight and dedication of its founder and the people attracted by his vision. Still, this is sometimes not enough; the founder of *ROM* also had many of the right characteristics, yet his magazine never really got off the starting block.

The Future

During the next few years, we will see many of today's personal computer magazines fail, as many of them are ill conceived and headed by people who lack true personal computing vision. However, we will also see many new magazines; the market for personal computing is not static.

Some people think that IBM will become such a dominant factor that machine-specific magazines such as *PC Magazine* and *PC World* won't be necessary. Others argue with equal vigor that Apple, AT&T, and the Japanese will establish standards of their own. As personal computing continues to grow, vertical magazines, such as those that now exist for lawyers, could become the next rage. The topic will probably remain the same, though the specifications may change. Perhaps there will even be a personal computer magazine for movie stars someday—if there isn't already.

The majority of today's mainstay publications, including *Creative Computing*, should survive until the end of the century. Beyond that it depends on how well their publishers transfer them to entirely electronic media. Once personal computers have super screen resolution and massive amounts of memory, we'll find ourselves realizing the long-held vision of reading our newspapers and our magazines on screen. The printing business will cease to exist except for the novelty of printed greeting cards and business cards.

It is ironic that the personal computer, which should be replacing the printing press, has thus far given the ancient craft of ink on paper its biggest shot in the arm since the advent of the mail-order catalog. David Ahl and I invariably end up lugging heavy boxes of magazines at trade shows—a hassle that the new technology is trying to eliminate.

Since my background prior to the Altair was in journalism and not computing, I am glad that this irony exists. It is hard to imagine personal computing taking hold of our collective imaginations so quickly without magazines. Magazines have spread the news about personal computers more effectively than any other medium including books, radio, and television. More importantly, magazines have helped to create whole communities of personal computer users. By subscribing to *Creative Computing* you automatically identify yourself with thousands of other personal computer users who have a similar orientation to computing.

I often wonder if the IBM Personal Computer would have had the same phenomenal success without the support of the machine-specific magazines it has inspired. I know from personal experience that many companies in the IBM third-party market got their start by advertising in *PC Magazine*. Apple certainly thinks that magazines influence the market, since they agreed to give me access to inside information so that I could launch the first issue of *Macworld* on the same day that they announced the Macintosh. Obviously, it is no accident that my company has been approached by several smaller personal computer manufacturers practically begging us to create magazines oriented to their computers. Luckily, we didn't respond to these pleas because most of their machines have flopped in the marketplace.

For me this historic issue of *Creative Computing* is more than a well-deserved tribute to David Ahl and his publishing vision; it is a tribute to personal computer magazines in general and to the vitality and lasting impact of the personal computer itself. So congratulations both to the people who produce *Creative Computing* and to the people who read it. Congratulations to all of us in personal computing. ■

THE GRASS IS ALWAYS GREENER/WAYNE GREEN

David, congratulations on your ten years with *Creative Computing*! Quite a feat building it to one of the largest magazines in the microcomputer field, I'd say. And mercy, it's nine years since I started *Byte* and eight since *Microcomputing*. We've sure seen exciting changes, eh?

Say, do you remember the morning we had breakfast together at the Disneyland NCC, both thinking we were at the Pertec breakfast, only to find it was next door. So we went there and had a second, better breakfast? I don't think we ever found out who the host for our first breakfast was. We've eaten together many, many times at press parties, both of us being consumate freeloaders.

We've watched an industry start from scratch—from that single MITS Altair microcomputer kit (which didn't actually work)—and blossom into a multi-billion dollar giant. When

Wayne Green has made his career as the editor and publisher of magazines for computerists, amateur radio operators, and other technically interested people. His current computer titles include Hot Coco, 80-Micro, Microcomputing, Run, *and* InCider. Byte, *founded by Green in 1975, was taken from him in a stock proxy fight with his wife who later sold the magazine to McGraw-Hill. In 1983 Green merged his operations with the International Data Group, publisher of* InfoWorld *and* Computerworld.

Born in 1922 in Littleton, NH, Green became a radio operator in his teens. During World War II, he served as a radio operator and electronic technician aboard a submarine, the U.S.S. Drum, on war patrols in the Pacific Theater. After the war, Green returned to college, receiving a B.S. degree from Rensselaer Polytechnic Institute of Troy, NY. Recently Green expanded his business activities: Evergreen Software, Inc. publishes business and education programs and Instant Software, Inc., a chain of stores in Massachusetts and New Hampshire, sells programs, supplies, and peripherals.

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one remembers that first year (1975) with sales of only $5 million, one can appreciate that the industry has been growing at an average rate of over 250% per year. This remarkable growth has generated the most new millionaires since our government started paying farmers for not planting crops.

One of the seldom appreciated benefits of microcomputer magazines such as *Creative Computing* is that they make it possible for entrepreneurs to start small firms which then often grow into substantial businesses. Indeed, without magazines the microcomputers industry would have had a much more difficult time getting started.

To give you an idea of the power of this growth, I started a magazine specifically for TRS-80 computer owners way back in 1980. It grew from 132 to over 400 pages that year—and 600 pages a year later. Reader polls showed that this magazine was generating $30 million per month in mail order sales for the advertisers, and I don't think that was unusual in the field. That may help explain to newcomers why there are so many computer magazines. They help sell products, so they are needed.

Thousands of entrepreneurs responded by developing software, accessories, and information products for micros, and they flourished. Hundreds upon hundreds became millionaires. Some were able to cope with instant success; others were not. Thus we have seen the chaps who started Apple end up with enormous fortunes and Osborne with disappointment.

The Industry is still Growing

Our industry is still growing—certainly no slower than it has—and the opportunities for entrepreneurs are no fewer than they were eight years ago. Developing and marketing a product for one of the lower cost systems, where the computer is sold only via mass merchandising stores such as K-Mart, is a good way to go. Little in software or accessories is available through these mass outlets, so the computer owners have little choice but to subscribe to a magazine dedicated to their system and shop the mail order ads. Selling this way is like shooting fish in a rain barrel for entrepreneurs.

It is fun for us publishers to try to second guess the market with our magazines. Will the Macintosh make it big, carrying its dedicated magazines on to success as small firms fill its pages with ads for add-on products? Or will it be the PCjr? The Sinclair QL? Will our American schools be as kind to the BBC as the English were? We publishers look 'em over and then roll the dice with a new magazine. But we enjoy every minute of it, no matter how frustrating, right David?

Life has been made a tad easier for us publishers since the computer firms figured out that a new computer system really doesn't stand a prayer any more unless there is at least one dedicated independent magazine for its users.

More Magazines?

But how long can the computer industry continue to grow at such a pace and how many more magazines can there be? Well, with only a small percentage of businesses yet using computers and a tiny percentage of our kids using them in school, we have a long, long way to go. Add to that the potential home uses, and I see no slacking in the over 250% growth for some years.

Different computers and different user needs are going to dictate the need for more information sources—magazines. I have a list of at least ten new magazines I think are needed to help the field keep growing, and I'm sure you have a similar or even longer one, so I expect we'll see more, not fewer, magazines.

It's sad, in a way, that what started out as a great hobby for a few fanatics has grown up so soon to be dominated by a few billion-dollar firms. It was both eons ago—and just yesterday—that a bunch of T-shirted hobbyists gathered in Atlantic City for the first ever microcomputer show in 1976. That's where Steve Jobs rented a small table to show his Apple I and got twenty orders, starting him on his way to stardom.

> *It was both eons ago—and just yesterday—that a bunch of T-shirted hobbyists gathered in Atlantic City for the first ever microcomputer show in 1976.*

The T-shirts are long gone. Now we see three-piece suits and IBM

stripes at the show. No more jeans and frizzy hair. No more card tables show exhibits with handmade paper signs. It's big money these days, with show exhibits that can cost over $100,000. At Atlantic City I sold more than 1000 subscriptions to *Kilobaud Microcomputing* using a simple $35 sign in a single booth. Could anything like that happen today? Probably not.

Even you and I have had to bow to the pressure of big money, selling our magazine empirettes to larger publishers in order to keep from being overwhelmed. We have survived—and well. You seem to be keeping as busy as ever. I'm involved with starting a new kind of college to teach a combination of business and computers, a publishing school, a chain of computer software stores, a software protection system, and so on. It keeps me hopping around and having a good time.

Where will it be by 1994, David? Where will we be? Am I invited to write a 20-year celebration piece for *Creative Computing*? ■

AH, PROGRESS/ CARL HELMERS

David Ahl asked me to send a piece for the tenth anniversary issue of *Creative Computing*. I guess the reason he asked is that I might have had something to do with the early growth of personal computers. I got hooked on personal computing long before personal computers were even possible. I had the good luck in 1966 to take a Fortran course at my high school in Northern New Jersey.

> *Fooling around with the game of Life on a PDP 6 in 1971 convinced me there was more fun in programs than in wave equations.*

One thing led to another, and—wouldn't you know it—computer programming in Fortran, Cobol, PL/I, and assembly language paid for an undergraduate degree in Physics in 1970.

Fooling around with the game of Life on a PDP 6 in 1971 convinced me there was more fun in programs than in wave equations, so I left graduate school soon thereafter. I took a job working for a NASA contractor on some of the early software engineering projects for the Space Shuttle.

Rocket Ships to Silicon Chips

When the Intel 8008 was announced in the early 1970's, I was working at the Manned Spacecraft Center in Houston, TX. Those were the days when the executives of a then shaky startup company were on the road giving the engineering hustle for new products. With this announcement, I knew for sure that it was possible for me to have my own computer. The 8008 was a nice little black box (actually grey and gold colored like today's integrated circuits) that had all the necessary functions of a computer. All I had to do was wire it up.

So, I bought that little $120 chip and proceeded to contemplate it without action for a couple of years while I studied the mysteries of "synchronous digital circuits." I already knew about the software since I made my living with it but hardware had always been a mystery.

Carl Helmers speaking at the Atlantic City Show, August 1977.

Along the way, I made the decision to start publishing the results of my experiments, so I advertised with little classified advertisements in *Popular Electronics* (now *Computers & Electronics*.) Those were the days (ah, nostalgia!) of making computers by hand out of standard parts. Today, the only reason for wiring up a computer is to find out how it is done. Then, there were all the learning reasons plus the very compelling reason that you couldn't get a computer any other way.

That early self-publishing endeavor led to the second major personal computer magazine, *Byte*. I'll concede *Creative* the historical point of being "first." I always considered—with no small amount of pride—my magazine to be first from my point of view. Well, come what may, the magazine and the field flourished. I guess Dave and I first met face to face at the one and only World Altair Convention in early 1976.

Today, with a mature personal computer market, one can get a much more effective and useful computer for much less money and aggravation than it once cost to build one from scratch. I use these ubiquitous products of our technology every day—both at home where I am writing this and in the of-

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HAYDEN

fice. I am sitting here writing on a Sage IV computer using the Volition Systems "Advanced System Editor." I have at my beck and call a super database called Pascal Data Base System which is written by Tom Swan and soon to be available in the form of a widely published book of source programs. I compile Pascal programs at speeds ranging from 800 to 3000 lines per minute. I do all the things I used to do on a big time sharing computer—yet I do them at home with better immediate feedback and utility.

Those who long for days when creating something from scratch could produce a better result than you could get in a store are welcome to join us in the field of personal robotics experimentation.

Robotics and Bar Code

I am still in publishing—and in personal computers. Today, I spend my time worrying about the exotic and still experimental personal computer peripherals called robots. My present company publishes *Robotics Age*, the only widely available magazine for today's experimental computer field, robotics. Those who long for the days when creating something from scratch could produce a better result than you could get in a store are welcome to join us in the field of personal robotics experimentation. We also publish *Bar Code News*, the only computer magazine for the world of applications of optical bar code technology, and we have just started an engineering magazine called *Sensors—The Journal of Machine Perception*. We also write and produce documentation for new personal computers and peripherals.

With 32-bit 68000 chips and 256K dynamic memory parts, we all live in an era of unimaginable computer wealth. The technology was improved and will continue to improve. I can see future portable computers with high quality graphic screens, immense but lightweight databases and even methods of input that use hand writing instead of button pushing. We see the beginnings of such products in present peripherals and the latest generation of portables using small disk drives. I am sure that David and his associates at *Creative* will continue from a great start in the first decade of personal computing. ■

Computers and Education

Some of the earliest applications of computers were in education, indeed the first digital computers were developed at universities. However, it wasn't until the mid-60's that significant numbers of students became exposed to computers with the advent of timesharing terminals in classrooms.

All six writers in this section have been involved with computers for at least that length of time. Walt Koetke leads off this section with a plea for learning from the lessons of the past, while Ken Brumbaugh traces the history of MECC, one of the oldest educational computer organizations in the world. John Kemeny, co-author of the Basic language, points out the value of programming for learning other subjects.

Gordon Bell, one of the designers of the first minicomputer (the PDP-8) spent a great deal of time teaching and, like Koetke, feels there are important lessons to be learned from the past, particularly as embodied in The Computer Museum.

In a fascinating series of 41 statements, Alfred Bork points out that while computers have invaded the schools of the nation, the educational use of them is often a disaster. David Moursund is only slightly more optimistic and believes that ultimately the student is the key for improvements in the educational system. ■

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COMPUTERS, CHILDREN, AND LEARNING: ONE COMPLETE ITERATION/ WALTER KOETKE

Walter J. Koetke, Jr. helped introduce computers into U.S. public schools; he proved their educational value in Project LOCAL, a pioneering program in the Lexington, MA school system in the 60's. Koetke joined Scholastic Inc. in Septermber 1983; as director of technology, he is involved in all of Scholastic's computer-related activities. Within the Scholastic Software Group, he has direct responsibility for the product development staff.

Koetke spent 15 years in the Lexington, MA, school system, in which as a math teacher he began to explore classroom use of the computer in the early 60's and gradually changed the system into a model for educational computer use. He has written computer curriculum material, including two algebra textbooks, as well as articles, columns, and product reviews. A 1962 graduate of M.I.T., he also holds a master's degree in teaching from Harvard University.

The perspective used in many of the drawings of M.C. Escher is convoluted and iterative. As your eyes travel up the stairs, around the corner, again up the stairs, again around the corner, and yet again up the stairs, again around the corner, and yet again up the stairs you find yourself once again at your starting point at the bottom of the stairs. After repeating this process a few times, the curious are compelled to discover how Escher drew the impossible and to ask what was he telling us. Escher's perspective is iterative, a surface contradiction of terms that I believe reflects an insightful understanding of history and the nature of man.

Much of history is both cyclical and iterative. No man has ever gone to war without "god" on his side, and no war has ever ended without sincere pledges of eternal peace on both sides. The rises and eventual falls of our world's great civilizations share a host of common characteristics. Even the pendulum of politics in the United States is predictable as it swings from conservative to liberal to conservative and so forth.

Most of learning is both cyclical and iterative. There are almost no significant topics that can be put on a checklist and completed in a given grade or semester. Hopefully, one studies mathematics and writing for at least 12 years. Each year is built upon the skills learned in previous years. Each year, previously learned skills are reinforced and new ones learned. Those fortunate enough to have been guided by skilled teachers are prepared to continue this iterative learning process throughout their lives as the same process applies not just to other academic subjects but to interactions with other people, job skills, and even personal care.

The tenth anniversary of Creative Computing corresponds rather closely with the twentieth anniversary of children being able to use computers in their schools.

The Importance of History

The importance of history is not new. George Santayana summarized accurately when he said that those who ignore the lessons of history are compelled to relive them. The tenth anniversary of *Creative Computing* corresponds rather closely with the twentieth anniversary of children being able to use computers in their schools. For those fortunate enough to have worked with children and computers for those 20 years, history has already provided many lessons. There are many who feel they were born too soon to fully experience the impact of computers.

Although we have only begun to fantasize the full impact of technology, the past 20 years have clearly been the exploratory probe of the use of computers in school and home, and I feel very fortunate to have been a part of this stimulating period. Watching the excitement of a handful of teachers and the enthusiasm of a few hundred students grow to today's widespread use of the microcomputer as an individual, intellectual tool of so many minds is very satisfying. Let's look at computers, children, and education in the light of this 20-year history.

I would like to highlight some of those areas in which one iteration of historical perspective might be helpful. For example, there continue to be those who claim children should not use computers in school until their effectiveness is proven. A classroom where learning occurs is a series of constant interactions between teacher and students and among students themselves. If one avoided any interaction whose effectiveness was not proven, nearly all learning would be paralyzed. Learning occurs when teachers guide, prod, and stimulate, not when they steer, force, and regurgitate.

Certainly there is much research to be done regarding the application of computers to the learning process, but there is nothing to be gained and minds to be lost by using that as an excuse for doing nothing today.

Another argument that often brings paralysis is that of which programming language students should be learning. Ten years ago the academic debate was over Basic, Cobol or APL. Today we listen to debate regarding Basic, Pascal, or Logo, and I suggest that five years from now we will be subjected to debates regarding Basic, C, or Logo II.

Academic debates are fine; society has always had them and hopefully always will. But don't let their inconclusive nature prevent action. Teaching children any one of today's debated languages is far more important than *which* language is chosen.

With the advantage of a 20-year perspective, I continue to believe that we should be teaching children to program. Arguments against doing this are primarily analogies: I can drive a car without knowing how to repair the engine; I can use a microwave oven without the slightest idea of how the food is really heated; and so forth. These arguments sound pretty good until you realize that the analogies just don't apply. Automobiles, microwave ovens, and all the other devices commonly noted are not interactive, intellectual tools.

The computer is just a machine, but it is a machine that can extend our intellect. There is no doubt that most people will use software written by others in most instances when they use the computer, but that does not eliminate the importance of learning to program. The computer is often called a wonderful "What if?" machine as we can use it to explore so many different questions. Most of these questions are explored by those who can write programs.

Back to the Bottom of the Staircase

Watching schools begin to explore the virtues of networking microcomputers within one or two rooms is like returning to the bottom of an Escher staircase. The first time sharing systems placed in schools 20 years ago were plagued with difficulties that took years to resolve.

Today, a full scale, time shared minicomputer has many applications in the learning process. A networked microcomputer system has very few as it now faces nearly the same difficulties that surrounded the first few years of time sharing in the schools. In the majority of cases, the schools are spending time and money on microcomputer networks to obtain most of the disadvantages and almost none of the advantages of time-sharing systems.

I also suggest that microcomputers are highly successful because they are individual tools. As soon as the microcomputer becomes an appendage of a larger system, an important part of that individualness is lost.

Given that most educators have long accepted the importance of iterative learning, many seem unable to apply that knowledge to the application of computers in the schools. The debate as to whether Computer Science and/or Computer Literacy should be a distinct one- or two-semester course or should be woven throughout the existing curriculum and taught when appropriate seems to ignore such acceptance. We are dealing with one of the most important concepts and tools developed by man, yet some continue to hope they can check it off as they do a driver education or a typing class.

> *Teaching children any one of today's debated languages is far more important than which language is chosen.*

The Not One Challenge

When speaking of history in *Creative Computing*'s anniversary issue, I am compelled to pass along the results of what has become my favorite problem of those I contributed to those early issues. In the first issue I wrote of a game called Not One taught to me by a five-year-old. This is an easy two-player game requiring only a pair of dice and a few simple rules.

Players take turns, and each player gets ten turns in one game. The points you score on each turn are added, and the one who scores the most points wins. On each turn your first roll of the dice is very important. You may roll the dice as often as you like on each turn, stop rolling whenever you choose, and your score for the turn is the accumulated sum of the dice rolled on that turn.

The catch is that if during the course of rolling the dice you obtain the same total as you did on the first roll of that turn, your turn is over, and your score for that turn is zero. Readers were challenged to determine the best strategy for playing the game and to write a program that would permit a user to play against the computer.

The result of the Not One challenge is one of my most treasured files. A very large number of readers submitted their strategies and programs. Some never won the game, and some played very well. The response file I retained, however, was very selective. The file contains only responses in which the writer included a convincing "proof" that his strategy was the best possible and which was submitted by someone whose academic credentials included the Dr. prefix.

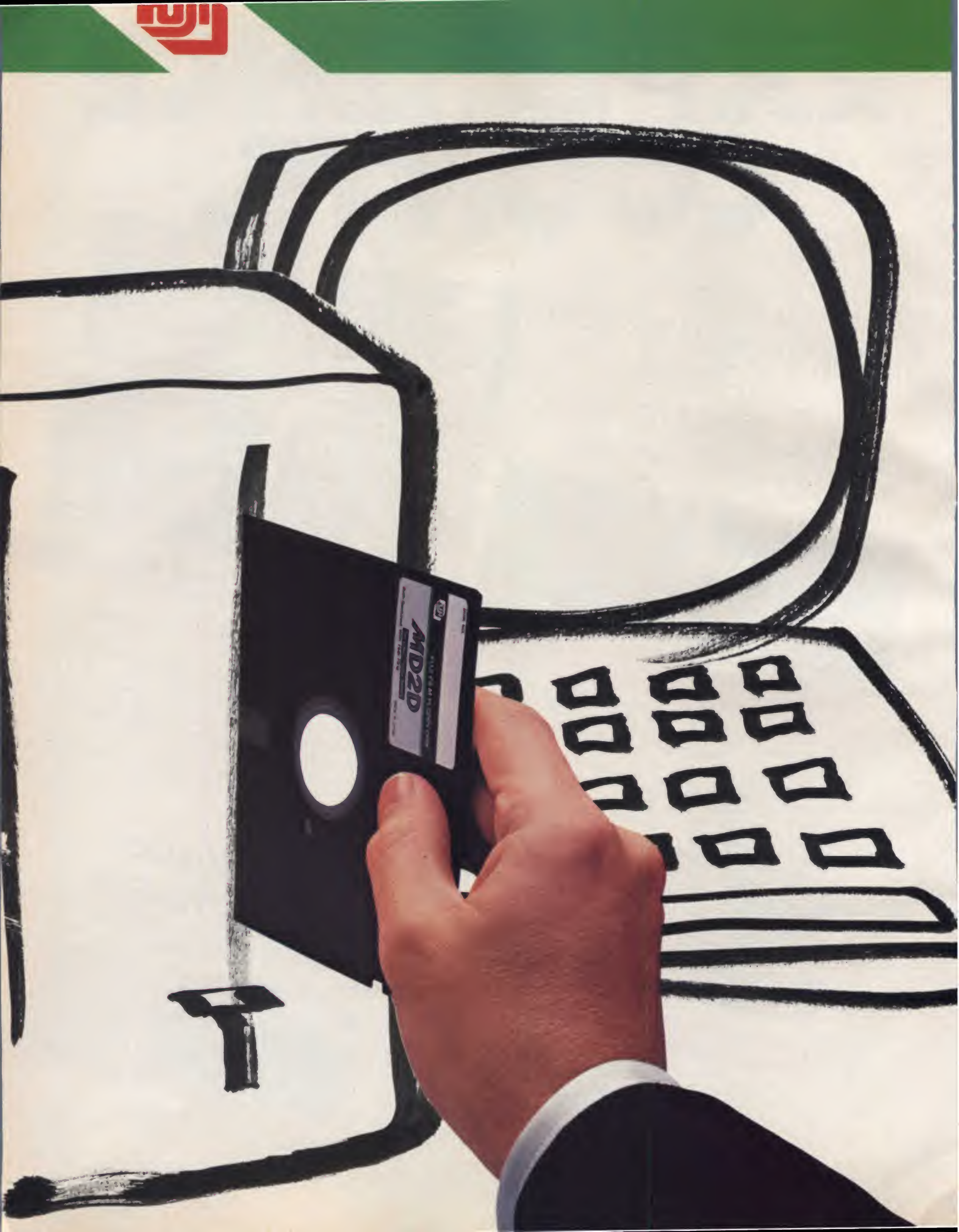
The file is nearly $1\frac{1}{2}''$ thick and contains some terribly convincing arguments. Delightfully, there are not identical strategies in the entire file. In fact, they are all quite different. I have yet to see a definitive solution to this innocent sounding problem. If you think you have the best strategy, I'd love to see it.

Try writing the program to play the game. The different mathematical ideas you will encounter as you explore this simple game on the computer are very rich. This problem has been addressed by inquisitive minds of all ages during the past ten years, and I suggest that the learning that resulted would not have happened if the computer were unavailable. Perhaps I should add that no one will ever see my file of responses. The purpose of the Not One challenge was and is to stimulate learning, not to embarrass the learner for an incorrect answer from which a great deal was learned.

Whither Public Education

As an un-swerving supporter of public education, I am very concerned about its diminishing chances for survival. Recent history has demonstrated that free enterprise in the private sector can and will effectively replace a public service when that service is no longer perceived as effective or appropriate. The rapid growth of private mail and communication systems in this country is evidence enough. Without drastic reform that brings the curriculum of our schools into the age of technology, I regretfully suggest that our venerable institution will not survive in anything like its present form.

In mathematics, for example, there are almost no skills taught from grade one through the first year of cal-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culus that can not be performed on a microcomputer using $200 worth of software. If your reaction is that there are many important skills that should be taught because they should be understood by every educated citizen, you are absolutely right. But those are not the skills being taught in today's mathematics curriculum. Similar though less dramatic examples can be made in virtually every curriculum area in public education.

My concern for public education is not ill founded. Virtually every publisher of educational software developed for schools is also marketing that software to the home with a good deal of success. The truth of the statement that technology will change who teaches, what is taught, and where teaching takes place is becoming more evident each day.

There is still time for our schools to take the lead in the use of technology as it applies to learning. In my own version of Utopia, a parent who wants to know what software will help his child learn a specific concept or skill will call the school for advice, not the local computer store as is now the case.

Although predicting the future is an inaccurate business, my experience suggests that schools have only two or three years left in which they will be able to again grasp the reins of educational leadership, and that can only be done by making rapid changes in an institution traditionally slow to respond.

David Ahl (L) demonstrates education programs on the Apple at Clemson, SC, May 1979.

Education in Technology

The need to provide a sound education in technology to all citizens is very evident. Intelligent understanding and application of technology can be as important to a country's economy as the production of technology. The United States lost its prominence as the leading producer of fine steel because Japan understood and applied better technology developed elsewhere as it built newer steel mills. Japan now sees that its prominence will be replaced by the even newer, technologically superior steel mills being built in South Korea and India. Japan's sudden prominence and equally sudden anticipated replacement are typical of changes that will be produced by those who understand and can apply technology.

I also suggest that a sound education in technology is important so that as members of a free society we can vote intelligently on matters related to technology. We are already faced with important technological decisions, and there are some unusual choices being made at present. The only justification for many of the choices seems to be lack of information.

For example, near the end of 1985 and during early 1986 the path of Halley's comet will come as close as it ever gets to earth, a position that occurs only once every 76 years. We have a once in a lifetime opportunity to meet the comet with a space probe and possibly gain great insights into its nature and the nature of where it has been.

The United States will not launch such a probe on the grounds that it costs too much. However, France, Japan, the Soviet Union, and the European Space Alliance have all managed to find money to fund such exploration as an investment in their futures. On the other hand, the United States appears likely to invest one billion dollars in the development of a new destroyer for the Navy. In an age in which technology has reduced the Navy to two kinds of ships, submarines and targets, we are going to build the first billion dollar target. These do not appear to be decisions based on an understanding of technology and its application.

The Soviet Union and perhaps other nations are reported to be exploring the feasibility of building a large satellite that includes a set of controllable mirrors that would reflect sunlight to earth. The reflected light would be used to light major cities at night and thus effect huge reductions in energy consumption. The reflected light would also be used to provide extended daylight in crop producing areas and hence increase productivity and feed many more people. A terrific idea.

A sound education in technology is important so that as members of a free society we can vote intelligently on matters related to technology.

Would you vote for it? Have you considered the impact of the additional light on the average temperature on the earth? How many degrees must the average temperature increase before the polar caps melt and drastically change the world's geography? Probably a lot fewer than you would guess. Living in a society so steeped in technology requires that every citizen understand the basics of technology so that he can make informed decisions regarding its application.

Although technology is evolving at a staggering rate, history has provided lessons that we should heed. Although the use of computers in the learning process is just beginning, there are 20 years of lessons that can save time, money, and frustration. We must continue to take two steps forward, but always look at least one step backward to see what might be learned. And whatever you do, don't wait. Whether you are motivating yourself or leading a class of eager young learners, I would like you to keep an image in your mind.

I first saw the image in a very early issue of *Creative Computing.* The image is the figure of Einstein as a young boy sitting in front of a microcomputer. The caption beneath the image simply says "What if?" ■

REFLECTIONS ON EDUCATIONAL COMPUTING/ KENNETH BRUMBAUGH

Kenneth Brumbaugh is executive director of the Minnesota Educational Computing Consortium (MECC), one of the oldest and largest educational computer using groups in the world. Brumbaugh has a doctorate in science education from Wayne State University, Michigan and an M.S. from the University of Wisconsin, Milwaukee. He was a science education instructor at Wayne State and an instructor of physical science at Towson State College in Maryland.

He established MECC institutional memberships and the User Services Team. Brumbaugh was responsible for MECC/Apple II and Atari volume purchase contracts. He was chairman of the Minnesota Microcomputer Task Force, 1977-78, and was responsible for MECC's instructional computing courseware development.

I first met Dave Ahl some ten years ago—at the same time the first issue of *Creative Computing* appeared. Perhaps that is why he asked me to share a few of my thoughts in this special issue. Although I am not sure if this is what Dave wanted, here are some personal reflections on educational computing, then and now.

Nineteen years ago I began using computers as a supplement to the math and science classes I was teaching. Ever since then I have been directly involved in the use and support of all purpose instructional computing at local, state, national, and international levels.

In those early years computing educators were faced with problems such as the availability of funds, isolated and narrow base of activities, and the need for individual and institutional acceptance. Today a much larger group of computing educators is still faced with the problem of funding along with several new ones. Now they face an enormous array of computing equipment to procure, an even larger body of quality computer software, and extensive curricular planning.

Timesharing in the Schools

In 1965, when I began teaching with computers, student interest in timeshared computing was overwhelming. A school considered itself lucky if it had a single computer, so naturally students and teachers pulled many strings to find ways to maximize its use. School custodians were taught to enter student paper tapes at night and even bribed to open buildings at odd hours. I remember an average student who wrote a sophisticated computer program to track missiles and completed it in several months. It was then I knew that this thing called *the computer* was not going to be a passing fad in education. It made kids smile and want to try more. And it still does!

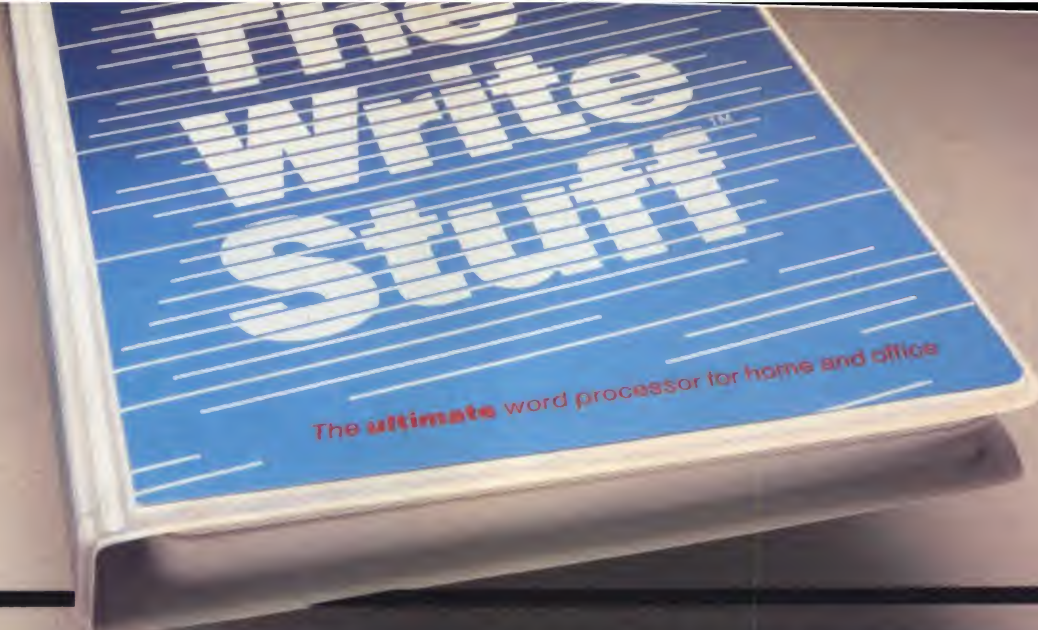
My college teaching in the early 1970's was highlighted by the receipt of two National Science Foundation Grants to develop instructional computing courseware (computer programs and the related teacher support manuals) for use by secondary mathematics, science, and social science teachers. Others such as Lud Braun at Stony Brook, NY had made similar efforts but, in general, colleges and their faculties were not attuned to the growing interest and need for all purpose instructional computing materials. Most college educators at the time thought that computing in schools meant simply learning to program. Today we see the computer being used in all disciplines and at all levels of education for simple and complex programming *and* as a valuable supplement to conventional instruction.

In 1974 I was fortunate to be one of the first employees of the Minnesota Educational Computing Consortium. MECC has since evolved into what many educators believe is the best example of an all purpose educational computing support organization in the world. MECC's early years were difficult and fraught with many problems but, nonetheless, rather enjoyable. MECC staff, hardware manufacturers, teachers, and students all seemed to be experimenting with computers in the classroom. Attempting to serve two thousand terminal users with a four-second response time on a 448-port timesharing computer that was designed to do only batch computing made life interesting to say the least. It seemed that everyone appreciated the situation and was willing to accept the difficulties in order to have his chance at computing. MECC rapidly solved the problems of providing timeshared computing to a diversified user base and, for several years, had one of the world's largest and most successful timeshared computer systems.

School custodians were taught to enter student paper tapes at night and even bribed to open buildings at add hours.

The Advent of Microcomputers

I recall several other significant computing events in my life. One occurred in November, 1977, when Don Holznagel (Northwest Regional Educational Laboratory, Portland, OR and formerly of TIES, Minnesota) delivered a Tandy TRS-80 Model I computer to my door. As I remember,



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I stayed up most of that night and spent the next several days playing with it. From that moment on, it was apparent to me that educational computing would soon change radically. That simple, inexpensive, portable device offered a solution to many of the problems facing those of us whose job it was to foster this growing field. Several months later, MECC undertook a study of microcomputers to ascertain which one should be selected for use and support in Minnesota.

The awarding of MECC's microcomputer contract to Apple Computer, which I believe established a standard for the educator's computer in this country, brings two other interesting events to mind. The first occurred the day that contract bids were going to be opened by the State Procurement Office. The bid from Apple was delivered to the correct office with *75 seconds* remaining before bid closing. I often wonder what might have happened to MECC and to Apple if that bid would not have been delivered in time: Minnesota educational institutions have now obtained, through MECC, more than 10,000 Apple computers since that day. Bids were also received that day from computer manufacturers that no longer exist, including Astral, Compucolor, and REX.

The second event occurred shortly after we awarded the bid to Apple. During a one-day meeting at the Apple office in Cupertino hosted by Roger Cutler, the Apple employee who persuaded Apple to submit their bid to MECC, I met nearly every key person in Apple at that time. Today, meetings with Jobs, Markula, Scott, and Carter, or their equivalents could not, quite understandably, be so easily arranged. Mike Scott, then president, took me on a twenty-minute tour of the entire Apple complex, which at that time consisted of two rather modest looking buildings. Apple now has numerous buildings in 24 locations throughout the world, housing approximately 5000 employees.

The Creation of Courseware

The changes that the 1980's brought for me and for MECC included the establishment of a formal process for the creation and distribution of microcomputer courseware. MECC now produces several courseware products each week, approximately half of which are for the Apple II and the remainder for IBM, Commodore, Tandy, and Acorn computers. Similar growth in the area of MECC in-service training and conferences, which attracts tens of thousands of educators each year, also means that individuals must now work together in teams to handle the volume of activity. Supporting instructional computing is an enormous undertaking.

Perhaps my most sensational computing experience came when I spent an entire Thanksgiving vacation learning how to use a Lisa computer. The capabilities of this machine are phenomenal. The integration of its hardware and software produce capabilities which are easy to use in an office system environment. This machine and the others that will follow should permit both clerical and management staff to do more in less time. When I began using computers, a system with the capabilities of the Lisa would have cost several hundred thousand dollars and would have required a computer center facility and staff to function properly; now it sits on my desk and plugs into the standard electrical outlet. I am forced to wonder, "Can the world continue to move this fast?"

In summary, as I try to recall my years in educational computing, I keep thinking of the problems, the people, and the potential. The problems are being solved. People continue to be the key to success in educational computing. They will be the ones who will plan who is to do what, when, where, and why. They will be the ones who will find and acquire the right amounts and types of courseware and hardware. And their motivation will be the vast potential that the computer has and will continue to offer to educators.

A magazine such as *Creative Computing* can do a great deal to eliminate what is and probably will continue to be the biggest hurdle to high quality and quantity use of computers by educators; that is, getting the proper information to those who need it in a timely fashion. Thank you, *Creative Computing*, for featuring education in selected issues each year, as well as for the regular columns which provide important information to hundreds of thousands of educators around the world. ■

PERSONAL COMPUTERS INVADE THE CLASSROOM/ JOHN KEMENY

Each fall one speculates how the Freshman class may differ from previous classes. But we already know how the class entering Dartmouth College this fall will be unique: each member of the class will be strongly encouraged to buy his or her own personal computer. The college has made the terms so attractive (pay over four years, payments eligible for financial aid) that we expect that most students will graduate owning a computer.

Dartmouth College will be in the first group of institutions to make personal computers universally available. Personal computers are also appearing in significant numbers at other colleges and in our high schools. In the future they will constitute the most important tool for educational computing.

The question I want to address is: "What use will our colleges and high schools make of personal computers?"

There are some obvious uses. If the institution has the capability of connecting large numbers of personal computers to a mainframe (and Dartmouth does have a network that makes this possible) the PCs will be very fancy terminals. Second, PCs can be used for word processing; I am sure that future generations of students will write all term papers on their computers. Third, there is a variety of utility programs. And fourth, there are games. While these uses are attractive, I would like to suggest that if they define the scope of personal computing in higher education, those computers will have a negligible impact on the quality of education.

Whatever else a personal computer may be good for, it is first and foremost a computer—and a very powerful one at that. We now have an opportunity to integrate the use of computers into the curriculum to the

John G. Kemeny, professor of mathematics and president emeritus of Dartmouth College, came to the U.S. in 1940 and became a naturalized citizen in 1945. He served in the U.S. Army as an assistant in the theoretical division, Los Alamos Project (1945-46), and was research assistant to Albert Einstein at the Institute for Advanced Study (1948-49). He has a B.A. and a doctorate in mathematics from Princeton University.

He collaborated with Thomas E. Kurtz on the invention of the computer language Basic. Also with Kurtz, he invented the Dartmouth Time Sharing system. He was a consultant to the Rand Corporation in Santa Monica, CA, from 1953 to 1970. He is an internationally known lecturer and served as the chairman of the President's Commission on the Accident at Three Mile Island (1979). He has written several books, including A Philosopher Looks at Science, Man and the Computer, *and* Random Essays. *Among the books he has co-written are* Introduction to Finite Mathematics, Mathematical Models in the Social Science *and* Basic Programming *(with Kurtz).*

point where asking a student to carry out a computer assignment will be as routine as asking him to read a book. Putting first rate hardware into the hands of our students is only half the battle, however—and possibly the easier half. Readers of *Creative Computing* will surely be aware of the fact that the quality of software usually lags behind the quality of the hardware. And educational software is in a particularly sad state.

The major bottleneck in preparing good educational software is a lack of good languages for personal computers. And, typically, no two personal computers speak the same dialect of a language. Faculty members who have prepared excellent software for their classes are frustrated in trying to "export" them. Textbooks that include computer programs must be published in several different versions, each tailored to a particular personal computer. This is a very expensive and wasteful process. It is also a poor use of the resources of an institution: students are limited to a single brand of personal computer in using a particular software package. These facts have significantly retarded the availability of first rate educational software.

I hope I will be forgiven if I address my remarks to the most widely used language, Basic. After all, I did (with Tom Kurtz) invent the language!

Ugly Implementations

The versions of Basic available on personal computers are vintage 1970. The vast improvements made by modern computer science in all languages, which have been reflected in the more advanced versions of Basic, have had no influence on the Basic found on most personal computers. And as software houses wished to take advantage of the special capabilities of microcomputers, they added many new features to the language. Many of these implementations are ugly, and they violate the design philosophy of Basic.

The major bottleneck in preparing good educational software is a lack of good languages for personal computers.

Basic was designed as a fast, easy to learn language that protected the user from the peculiarities of hardware. The existing implementations are typically interpreters rather than compilers, and therefore Basic has acquired the reputation of being a painfully slow language. The implementations do not have good error messages; indeed there is a limitation on the *quality* of error messages that an interpreter can produce. And the addition of hardware-dependent features to the language has made various versions of Basic incompatible. Even versions of the language written by the same software house for two different personal computers are inconsistent in important ways.

Let me give some examples. From the beginning Basic refused to make a distinction between "integers" and "floating-point numbers." This is a distinction that creates great hardship for the novice programmer and can easily be handled by a good implementation. The reason for this distinction in other languages was that mainframes did not have floating-point hardware. As such hardware was built into machines, any excuse for distinguishing two kinds of numbers disappeared. I was horrified in trying Basic on the IBM PC to find that there were not two kinds of numbers but four!

Equally horrible is the fact that the programmer is forced to learn the peculiarities of a graphic screen in order to draw graphs. We have had an implementation of Basic at Dartmouth for many years that allows the user to express coordinates in a coordinate system of his own choice. It is this implementation that allows a faculty member to prepare a graphics program on one terminal, demonstrate it in the classroom on a different make, and give it to students to run on any of the graphics terminals on campus. It is this kind of design that would allow the same program to run on a wide variety of personal computers.

But there is an even more fundamental problem with the available languages. Educational software differs in a fundamental way from spreadsheet programs and word processors. The latter are used by typing appropriate commands and data; the user never sees the source code.

In educational software there are two reasons why users *must* examine source code. First of all, we want our students to learn how to program computers. Second, programs included in a textbook are an essential part of the pedagogic material. I am convinced that the best way to teach an algorithm is to teach it as a computer program. A

great deal of material in mathematics as well as in the sciences and social sciences deals with the teaching of algorithms.

If the programs are to be readable, they should be written in an elegant language. And the standards I found acceptable 20 years ago are now hopelessly obsolete. A significant contribution of computer science has been the literature on "structured programming." Modern versions of Basic are completely structured and allow the rewriting of horrendously messy and unreadable programs (in old-fashioned Basic) in a style that is both easy to read and much easier to debug. Those of us who have made the transition can testify to the fact that it is a relatively easy and painless process (much easier than learning programming in the first place) and that we would never return to old-style Basic.

A Bright Future

Until recently we faced the problem that, while the elementary portions of Basic had been standardized, no such standard was available for advanced, structured Basic. But such a standard was proposed in 1983 and this opens the door for widespread implementation of structured Basic. Tom Kurtz and I, together with three outstanding systems programmers, are in the process of implementing a powerful and elegant version of the language on a variety of microcomputers. And it would surprise me if we were the only ones engaged in such an important endeavor.

It is my hope that, as once elementary Basic made it possible for millions to learn how to write computer programs, a modern structured version of Basic will set new high standards for the quality of programs.

And as compatible versions of structured Basic are implemented on a variety of microcomputers, it will become vastly easier to export educational software and to get it published and distributed. I predict that within five years it will be very common for textbooks to include a floppy disk which contains copies of the program used within the book. It will then be possible to turn every dormitory room and every home into an educational computer laboratory. ■

COMPUTING HISTORY: A PERSONAL AND INDUSTRY VIEW/GORDON BELL

Each time I invest "in the past" it has future payoff.

The first time that I invested in learning was in 1966. I went on leave from DEC to become a professor at Carnegie Tech to learn about computer science. Even though I had already helped develop the first minicomputer (the PDP-8) and the first commercial timesharing system (the PDP-6), industry was unconcerned about the "science" of computing.

In 1967, Allen Newell, Alan Perlis, and Herbert Simon wrote a letter to *Science* and identified computer science. The next steps, what we now call "the third and fourth generations" weren't at all clear. At Carnegie, Allen Newell and I collected materials and objects from past machines to build theories. This resulted in a book entitled *Computer Structures* that influenced at least two generations of computer architects. The concepts of the DEC Unibus and general registers came from this work. Other Carnegie alumni extended and implemented these ideas in subsequent (and future) DEC computers. These developments came from a deep knowledge of past computers, and how they were used and gave some insights about the future trajectory of computer evolution.

In 1972, when I returned to Digital, the third generation of computing, based on the integrated circuit, was in full swing. While DEC had been almost alone building minis in the second generation, the technological barriers to building computers had been lowered with the IC. A company had only to understand packaging, logic design, peripheral interface design, and construction of software components to start in the business. By 1970, about 100 companies had formed or attempted designs; seven really succeeded, about 20 are still trying, and a whole flock are no longer with us, including American Computer, Atron, BIT, and Viatron. With some understanding of the historic generational patterns my goal was to get DEC into large scale integrated circuits and to establish the VAX line as a new standard. And ironically, this year 20 years after the first PDP-8 was built, sales of the machine were higher than ever since it is implemented on a single chip and embedded in a word processor.

Ironically, this year 20 years after the first PDP-8 was built, sales of the machine were higher than ever.

Now one of my goals is to consider not just the development of a single company, but of the entire industry —and not just architecture but programmers and users. To this end, I have been part of establishing The Computer Museum for everyone. The Museum came about through the generous sponsorship of DEC and Ken Olsen.

The Role of the Computer Museum

Opened in Boston in 1984, The Computer Museum has on display the first interactive space game, SpaceWar!; the first personal computer, the LINC, and the first mail-or-

der home-built machine, the Altair. The Computer Museum is designed to help visitors understand the evolution of computing. Computer generations, marking technological time, are the main organizing principle. The new technologies, startup companies, and new products of each generation are listed and displayed.

Every time I visit the museum, I get insight relevant to a current problem. A month ago while looking at the Honeywell 116, a very early IC minicomputer, and comparing it with Data General's first Nova, ideas about board size, pins, and function jelled. I also observed that nearly all of the micros repeated, for the third time, the time-worn memory management evolution path that began in 1960 with the Manchester University Atlas in the early 60's, which we followed with the Decsystem 10 in the late 60's, and then again with minis in the mid-70's. IBM's path was about the same with the 360/370 evolution and its minis.

The Computer Museum is not just for me and my engineer friends; a dozen high school students came to an esoteric lecture on coding in the 1930's given by Donald Davies of England's National Physical Laboratory. Asked if they got anything from it they replied that they were going to use some of the ideas on setting secure codes for their school computer.

When I tour the Science Museum in London with my British friends, they often recounted anecdotes of how the exhibitions turned people on to science and technology. Now I see the same thing at The Computer Museum: bright kids and curious adults have a place where they can learn how computers got to be the way they are today.

Until The Computer Museum was established, there was no place where the objects, films, and programs of the past were collected. The Computer Museum provides this for the present and future generations of engineers, programmers, artists, and hackers who will make history.

A View to the Future

Using the Museum to review the past, just as I did in the 60's at Carnegie, a view emerges of the future evolutionary path of computing.

The current computer industry is stratified by level of integration and completely product fragmented, offering the ultimate in entrepreneurism. Dozens of complete industries have been formed within a half dozen strata:

- Chips: microcomputers, peripherals, memories.
- Electro mechanicals: power supplies, disks, I/O, enclosures.
- Operating systems: communications, database access, human I/O.
- Languages: (eg. dozens of assemblers for a given micro), fourth generation languages.
- Generic applications: word processing, spreadsheets.
- Professional/discipline applications: general business.

With the vast supply of venture capital, all you need to establish a company is a computer with a word processor and spreadsheet.

This new technology permits many more new computer structures than ever before including:

- All types of desktop terminals and phones.
- Portable and desktop personal computers, workstations and shared computers.
- Supermicros which replace mini and mainframes while providing increased reliability and performance by replication.
- Hybrid computer-telephony base computers and switches.

With the vast supply of venture capital, all you need to establish a company is a computer with a word processor and spreadsheet. A perpetual motion machine for creating companies can be expressed in a Pascal-like way:

```
procedure VENTURE
    ENTREPRENEUR CYCLE
        while greed and not fear do
            begin
                write business plan;
                get venture funds;
                exit job;
                start new company;
                build product;
                sell product;
                sell company; (for
                  100 times sales)
                venture funds: =
                  liquidity;
            end
```

The restructuring of the industry is good for individuals who both take the risks and create new products. But on a national scale I have four concerns about this restructuring.

First, the value of the companies appears to be far larger than any potential market. At the beginning of 1984, 123 workstation companies had a valuation of tens of billions of dollars with a total market of less than $10 billion. At most, there may be room for a dozen first rate companies.

Second, while the cycle creates some innovations in computing, most of the products do not improve productivity. The "me too" less costly solutions really cost the user when the company fails and the user is forced to convert the software to a reliable supplier.

Third, the U.S. industry is robbed of a critical engineering resource by constant churning. At a time when we need massive resources to compete with the invasion of every size and type of Japanese computer, most energy is going into replicating trivial products.

And fourth, successful software companies all appear to violate their own entrepreneurial energy. They amass vast programmer staffs merely to evolve their single founding product. Having a large staff of programmers to improve a spreadsheet to new versions is like having Ernest Hemingway hire a team of writers to write Hemingway novels. Much programming may be best done as a cottage industry.

The answer to my original question about investing in the future versus the past now becomes evident. Quality investments that benefit both individuals and society need a long term vision based firmly on knowledge of our past.

The Computer Museum is more than the industry's attic, it provides a resource for observing major patterns and a forum for learning from the all-time great designs and people. I'm sure that you, like me, were strongly influenced by your first computer and have a story about how it affected your future choices. Now, with The Computer Museum a new opportunity is provided to amass these "stories" into the history of computing. ■

COMPUTER FUTURES FOR EDUCATION/ALFRED BORK

Alfred Bork, professor of information and computer science and physics, is founder and director of the Educational Technology Center at the University of California, Irvine, one of the leading projects in the world for research and development of computer-based learning material. The center's reputation is based on the graphic, interactive, individualized, computer-based learning modules it has developed.

Bork has been a leader in proposing future hardware systems for delivery of computer-based learning; he has lectured widely on the subject and ran an NSF-supported conference on intelligent videodisc systems. Bork's recent books include Computer Assisted Learning in Physics Education *(Pergamon Press, 1980),* Learning with Computers *(Digital Press, 1981), and* Personal Computers for Education *(Harper and Row, 1984).*

Education in the United States is in trouble. We are besieged by reports of difficulties. Many parents realize that things are not right in our schools. The unhappiness with our school system is unlike anything seen in the past. These problems have been documented in many reports, over at least a dozen years. But remarkably little, other than cosmetic changes, happens to improve the situation.

It is not my intent to dwell on these very serious problems of education in our country. Rather I want to consider the role that the computer may play in solving these problems and leading us toward future educational systems.

My tactic will be to present a series of *statements.* The purpose is to make my views clear and to focus on the major issues. Most of these issues are discussed in much more detail in my forthcoming book, *Personal Computers for Education* from Harper & Row, in *Learning with Computers* (Digital Press, 1981), and in papers developed at the Educational Technology Center.

General Statements Concerning Computers in Education

1. The computer is the most powerful new learning device since the invention of the printing press and the textbook.

2. The computer is important as a learning device because it allows us, for the first time in hundreds, perhaps even thousands of years, to move toward situations in which *most learning is interactive.* As we have educated larger and larger numbers of people (essential in a democracy), we have adopted undesirable passive modes of learning. With the computer we can create active learning environments for *all* students.

3. Interactive learning has important consequences. Because the computer is constantly interacting with the student, we can *individualize* the learning experience to meet the needs of each student. When education is individualized, it can be more effective. We need not "teach" something already known, and we can work in ways that are most efficient for each learner. Interaction, used well, also implies a high level of motivation, and thus can be an important feature in increasing time on task, an important factor in determining how much students learn.

4. As with any technology, the computer can be used well in the learning process or it can be used poorly. Moving computers into the educational process is no guarantee that learning will be improved. There is nothing magical about the computer.

5. Computers will continue rapidly to decline in cost and improve in capability.

6. Because hardware will become cheaper, and because we are becoming more skillful in developing computer based curriculum material, the computer will eventually become, in almost every area of education, the cheapest learning delivery system.

7. We should not seek the "best" way of using the computer in learning. The computer can be used in many different ways to aid many different aspects of the learning process. None of these should be eliminated at the present time, when our experience with first rate use of the computer is still extremely limited. Decisions should be made on empirical grounds, rather than on the basis of philosophical positions. We need to use the principles of science in deciding where computers can best be used in the learning process.

8. Because the computer is a revolutionary device in education, it will lead to new educational structures. To think of computers in terms of current schools and current universities may be very misleading. New possibilities, such as learning-at-a-distance environments, become much more practical in an educational system heavily dependent on the computer.

> *New possibilities, such as learning-at-a-distance environments, become much more practical in an educational system heavily dependent on the computer.*

Statements About the Current Situation with Computers in Schools

9. Computers are appearing very rapidly in schools. Although estimates vary, it is reasonable to assume more than 300,000 computers in United State schools. Recently the number has

doubled, or better, each year. Strong parental pressures assure that even in a time of financial strain schools are still buying computers at an amazingly rapid and increasing rate. Parental feeling is that "my child has an inferior education if the school doesn't have computers."

10. A recent study at Johns Hopkins (Becker) indicates the schools that have computers do not necessarily use them, or may very much underuse them. Even when computers are given to schools the school district may not actually let them be used in the schools.

11. The educational use of computers is often a disaster. One might reasonably argue that computers in schools at the present time are more harmful than helpful in the educational process, almost independent of the type of use. Students are, in some situations, being harmed by computers.

> *Teacher training is a major problem; few school districts are approaching it adequately.*

12. Teaching of programming in schools is a particular disaster area, building up bad habits which are almost impossible to overcome in later life. The major problems are Basic and teachers who do not understand modern programming style.

13. Almost all commercially available computer based learning material for school use at the present time is *poor.* Much of it is trivia.

14. United States teachers are poorly trained to use computers effectively. Brief workshops are entirely inadequate for producing adequate teachers who understand educational uses of computers. Teacher training is a major problem; few school districts are approaching it adequately. The training about computers offered in many schools of education is worse than no training at all. A few rare exceptions offer excellent training.

15. Schools depend on curriculum material. Good education demands that well tested learning modules be available to the schools. Very few teachers have the time, energy, resources, and know-how to develop their own learning units, except in very small ways. The notion that teachers can develop, extensively, their own computer based learning modules is not reasonable.

16. Computers have the *potential* for helping with the major difficulties that confront education. But it is not certain that potential will be realized.

Statements Concerning the Production of Learning Material Employing the Computer

17. The development of good learning material of any type is a nontrivial process. It demands competent people who know what they are doing.

18. Learning material must be carefully evaluated and improved, in one or more formative evaluation cycles.

19. The development of good curriculum material, regardless of the media involved, is costly. To develop a single college level course, the Open University (United Kingdom) typically spends about one million dollars. We can develop courses for less money, but quality is seriously affected.

20. Many of the stages for developing good curriculum units are independent of the subject area, the level, and the media involved. Developing good print base learning material has many similarities to developing good computer based learning material.

21. No effective shortcuts are available for developing computer based learning material. Although beginners in this field often assume curriculum material can be produced at little cost, experience shows that good material is almost never produced this way.

22. Authoring languages and systems are almost useless. Little good curriculum material has ever been produced using these systems, in spite of the fact that vast numbers of such systems have been developed, and in spite of the vast publicity they have received, I would guess that in excess of half a billion dollars has gone into such systems. Unfortunately major companies, and even major countries, continue to support such development.

23. If the vast amount of money spent developing useless authoring languages and systems had gone into quality development of computer based learning material, we would be much further along. These expenditures on authoring systems continue, draining away resources that could produce useful material.

24. In producing curriculum material a variety of talents are needed. Most good curriculum material, such as that in the Open University, and in the major curriculum development projects in the United States following Sputnik, used sizable groups of people with different talents.

25. Effective ways of producing computer based learning material exist and have produced sizable amounts of material at costs resembling those of any good curriculum development.

26. The ultimate test of any method of producing learning units including computer related material is the learning effectiveness of the materials produced.

Statements Concerning Computers and the Future of Education

27. The computer has the potential to solve most of our current educational problems.

28. The computer will play a dominant role in future educational systems.

29. Within twenty years the computer will be the major delivery system for education at all levels and in practically all subject areas, replacing books and lectures.

30. The computer may lead to a better *or* worse educational system. At present this issue is very much in the balance.

31. The Federal Government should fund vigorous research efforts to learn how better to use the computer in education. Current efforts are inadequate and often motivated by very specialized points of view. Diversity is the key to these efforts. There should be no national policy; the quality of the research should be the key factor in determining grants. Development cannot wait until this research is completed, but must proceed parallel to it.

32. Massive development of high quality learning material involving the computer is essential and should begin at once, primarily at the full segment or full course level. The computer should not assume to be the only medium. Development should take into account possible nontraditional organizations of schools and nontraditional delivery modes. The emphasis should be on *quality* and on

significant amounts of material.

33. This curriculum material cannot be produced by cottage industry authoring strategies. Production is a serious activity and must be considered carefully. Further research on production strategies is needed.

34. The new learning material may follow modes impossible without the computer, because the computer suggests new ways of organizing the learning experience, new ways of organizing courses, new ways of organizing schools, and new ways of organizing learning.

35. Learning-at-a-distance possibilities deserve further study. In many cases the new computer based learning materials may be able to follow distance learning strategies. This implies that in learning systems of the future fewer teachers may be needed.

36. Some of the uses of the computer in education will involve teachers. Teacher training—understanding how to use the newer materials and the newer media—is an essential component of curriculum development. Few teachers at any level, from earliest childhood to adult education, are prepared for the computer. Conventional methods of teacher training—preservice and inservice lecture and textbook courses—are inadequate.

37. The computers should be the principal learning device for teachers in training programs. Curriculum development in courses where teachers are to be involved must take this into account, producing the teacher's material as well as the students' material. Teachers must have direct exposure to computers.

The computer should not assume to be the only medium. Development should take into account possible nontraditional organizations of schools and nontraditional delivery modes.

38. Much funding is essential for new learning material. There must be Federal leadership and Federal funding. Funding can also come from the states, from possible commercial vendors of the materials, from foundations, and from interested industries, particularly those with a technological basis.

39. Centers should be established all over the country for both research and development. While these centers should work together, in the sense of talking with each other and cooperating on some projects, a friendly rivalry between centers should assure diversity of approaches and materials.

40. Decisions of the next five to ten years will strongly influence our educational system for a long time in the future.

41. We have little time to alter the future. Many factors already suggest a "bad" direction. The question is one of establishing suitable models and directions—hard to change once they are fully in place.

42. The time to begin quality development is *now.* ■

TO IMPROVE EDUCATION/ DAVID MOURSUND

Dave Moursund is a professor in the Department of Computer and Information Science and in the College of Education at the University of Oregon. In 1971 he helped found the Oregon Council for Computer Education and started the organization's journal, The Oregon Computing Teacher, *in May 1974.*

In August 1979, he founded the International Council for Computers in Education (ICCE), a non-profit professional organization with more than 14,000 members, the largest professional computers in education society in the world. Moursund is editor-in-chief for ICCE publications, including The Computing Teacher *and the* SIG Bulletin. *He has written or co-written about a dozen books and many articles on educational uses of computers.*

My personal involvement in education goes back to 1936 when I was born of parents who were both faculty members in the Department of Mathematics at the University of Oregon. I was raised in a family that believed in education and set high educational goals. Thus, it is not surprising that I stayed in school until I completed a doctorate in mathematics and became a research-oriented professor in that field.

What is perhaps surprising, however, is that I am now a computer educator, a person who spends full time in teacher education, writing, planning, and working to improve precollege education. I have not taught a mathematics course for many years, and my knowledge of that field is gradually fading.

My transition from research mathematician to computer educator began in the summer of 1965 when I volunteered to teach a numerical analysis course to secondary school math teachers in a summer institute. The course was not very successful (which is a polite way to say that I didn't do very well) but it started me working on the problem of trying to integrate computers into precollege education. It also made me aware of how difficult it is to be a successful teacher of teachers.

In the summer of 1966 I was director of a National Science Foundation Summer Institute for teachers, and I have maintained a high level of involvement in teacher education ever since. I believe that I have learned a lot about education during the past 20 years, and in this short essay I would like to share a few key ideas.

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Education is a Massive System

Most people who write or talk about improving precollege education seem unaware of the massiveness of this system. In the United States there are about 45 million precollege students enrolled in approximately one hundred thousand public or private schools. More than 2 million educators are involved in this system that spends well over $100 billion per year. There are more than 15,000 public school districts; issues of local, regional, state, and federal control are all important in the functioning of each school district.

It is often said that it takes 50 years to make a significant change in our educational system. While the time line for a significant change can be argued, it is easy to see why change takes time and substantial effort. Our educational system is massive, and it has a momentum born of many years of tradition. It resists change. Give our educational system a push and it gradually returns to its initial position. A huge new federal aid-to-education program might spend a billion dollars a year for several years. But a billion dollars is less than one percent of the yearly school budget, and after a few years the federal program ends. As likely as not, after a few more years the effect of those billions of federal dollars is barely discernible.

Interestingly, I estimate the total cost of computer equipment now being used in precollege education at well under a billion dollars. Is this enough to have a significant impact?

Teacher as Change Agent

My main approach to educational change has been through working with teachers. If I can change a teacher, that teacher can change the education of hundreds of students. The multiplier effect is appealing.

In my earliest days of running summer institutes for teachers I helped many teachers to understand how computers can change the basic nature of mathematics education. I assumed that as soon as teachers gained insight into the capabilities of computers they would completely reorganize the courses they taught. What a naive assumption! Of course no appreciable change occurred! How could it, when there were no computers in the schools, no appropriate textbooks, no time for teachers to rewrite the curriculum, and no encouragement from school administrators, school boards, and parents to make such changes?

I still believe that teachers are an essential part of any change process in education. But teacher education by itself has limited potential. An individual teacher is locked in by tradition, standardized testing, a huge work load, and many other barriers to change. Imagine a fifth grade teacher deciding to omit paper and pencil long division from the math curriculum, replacing it with calculator use. An individual teacher cannot make such a change, even when backed by recommenda-

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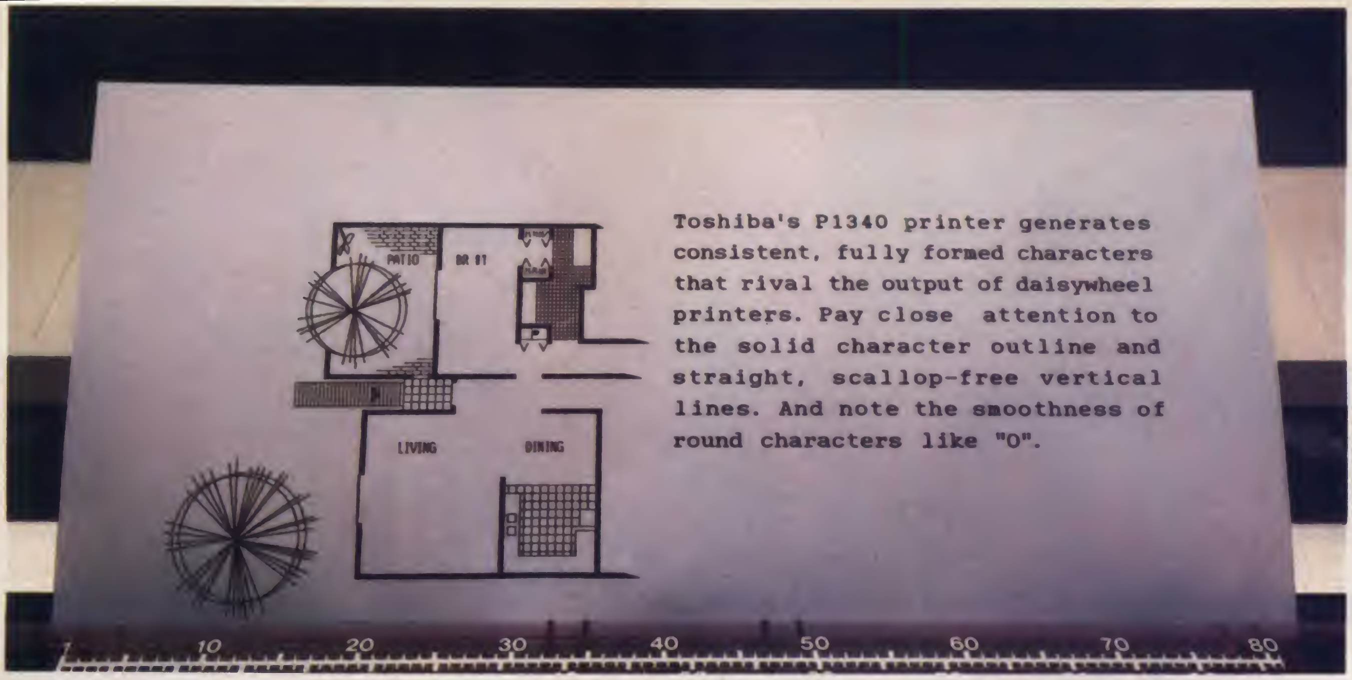

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tions from the National Council of Teachers of Mathematics and the National Council of Supervisors of Mathematics.

Computer as Change Agent

Another of my early, naive assumptions was that the mere existence of computers in higher education and throughout business, government, and industry would cause massive changes in precollege education. How could a computer-knowledgeable teacher continue to teach the same old things in the same old way?

> *Imagine a fifth grade teacher omiting paper and pencil long division from the math curriculum.*

A more recent, still naive assumption was that if the computer-knowledgeable teachers had reasonable microcomputer access in schools, significant curricular changes would certainly occur. Students could see the machines and could learn to use them. Then the curriculum would change.

Over the past five years we have seen a very rapid growth in computer availability. In schools in the United States we are rapidly approaching a level of one microcomputer or computer terminal per 100 students. Many secondary schools have 30 or more micros—a classroom set as well as miscellaneous machines scattered throughout the building. Certainly many schools now have enough computer access to support significant changes in the traditional curriculum.

But where is the change? Has the geometry course changed? How about science labs? Maybe we can find changes in business classes, art classes, music classes, English classes, or history classes? To some of these you might respond "yes" and point to a specific small change. But the basic nature of precollege education in all of these disciplines remains unchanged.

Computer-related changes are occurring, and the actual change can be divided into three parts.

1. A very large number of students are taking computer literacy, computer programming, or computer science courses. Such instruction is even reaching into the grade schools.

2. Some computer use has been integrated into some parts of some schools' curriculum. Certainly we can see substantial use of computer-assisted learning in many schools.

3. Computers (more generally, micro-electronics), as one of the dominant underlying factors in high technology, are forcing a reexamination of the curriculum.

It is the third point, computer as change agent, that is critical. The now-apparent ready availability of computers and the general recognition of the importance of high technology are forcing our educational system and individual schools to reexamine what it is they are doing. This reexamination is healthy; it is fundamental to any significant change in the system.

As a consequence of this reexamination many states and individual school systems are requiring students to take more solid courses in math, science, and English. They are beefing up graduation requirements and encouraging teachers to assign more homework. While some states and school districts are beginning to require that their students become computer literate, the changes that are occurring go far beyond computers. The changes are attempts to require that the overall quality of student education be improved.

The Student is the Key

An educational system is an environment designed to facilitate learning. But what he learns and how well he learns it is ultimately up to the student. Surprisingly, we often lose sight of this fact.

All of us have seen students of approximately equal academic abilities make far different types of progress in school. All of us have seen that some students work harder, take harder courses, and set higher personal goals than others. An educational system makes opportunities available—it is not a panacea.

Ultimately the individual student is the key. Thus, perhaps, we are led to a philosphical discussion of what motivates a student. I certainly can't cover all possible bases in this short essay. We can look at external rewards such as high grades, praise of parents, scholarships and the possibility of entrance into the best college or university. We can look at an inherent desire to learn, to grow, to achieve, and to in-

crease one's potential. We can work on all of these, and more. And, of course, we can be aware that computers have strong motivational powers for many students.

I believe that the greatest potential for improved education in this country lies in helping students learn to take responsibility for themselves. This should begin at the very earliest grades (and, of course, even before children start school). "What is it that I am expected to learn? How does it tie in with what I already know? Why should I want to learn this? How can I tell if I have learned this new material?" Questions such as these should be ingrained in all students. The goal is to have every student become a self-reliant and independent learner.

Computers, of course, can play a helpful role in an educational system of self-reliant independent learners. Over the next 20 years computers will significantly supplement books as a source of information. Computers will supplement teachers as a source of instruction, testing, and feedback. Computers will become individual tools, as pencil and paper are today, to aid in the learning and problem solving process. But the student as self-reliant and as an independent learner is not dependent on computers, and progress towards such goals can occur in the absence of computers.

Thus, each reader of this essay can help to improve education. If you are a parent, interact with your children to help them become more self-reliant and independent learners. If you are an educator, stress this idea when working with students and other educators. And don't forget to do the same thing for yourself. If you feel the need to learn more about computers or some other topic, decide for yourself what you want to learn, why and how. Set your own standards for measuring whether you have gained the skills and knowledge you seek.

For me a clear picture emerges from the type of analysis given above. The educational environment can be improved, and educational goals and requirements can be changed. Computers will play an increasing role as change agent as well as within the curriculum. But far bigger improvements are possible if we can help students to take increased responsibility for their own education. The key to improved education is students, not computers. ■

Philosophy: How It Ought To Be

It is easy to stand outside a field and point fingers, predict, and give advice. "The government is too big. They should cut spending." Or how about, "Detroit builds lousy cars. They should follow the lead of the Japanese." But when insiders sit back for a moment and observe, we should pay special attention to their thoughts. In this section 19 knowledgeable people have taken the time to observe and speculate on the advances and foibles of the personal computer field.

Michael Crichton observes that computers show us both the benefits and the limits of rationality with wonderful precision, while Adam Osborne discusses the destiny of the industry to continue to grow in entirely new ways.

Lee Felsenstein, designer of several notable computers, discusses the forces that made the industry what it is today. Don Estridge of IBM discusses just what it is that makes a computer personal, while Tim Hartnell feels that computers aren't personal enough—not yet anyway. Bill Godbout continues on this theme and says that we must be aware of what computers both can and cannot do, while Will Fastie points out that the performance of current personal computers may not be so good after all.

David Tebbutt, a former editor of Britain's *Personal Computer World,* discusses the importance of learning from the leadership (and mis-

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takes) of others. Another former *PCW* editor, Peter Rodwell, asks the probing question, "Who's in control?" And on the subject of control, Harvard Pennington considers the virtues (and problems) of mice, windows, and icons. Rodnay Zaks discusses the problems of producing truly useful software, while pundit Ted Nelson takes a tongue-in-cheek look at easy-to-use software.

Tom Kurtz, co-author of the original Basic language talks about a new, better Basic, while Seymour Papert, designer of Logo, speaks of misconceptions about the language.

Game designer extraordinaire, Bill Budge, tells us that good program design is difficult and demanding. Recognizing this, Jim Levy, president of Activision, feels that a major challenge in the industry is to continue to discover and develop new creative talent. Another crucial industry problem is that of piracy according to Mitch Kapor, designer of *Lotus 1-2-3.*

What will computers do for us—for everyone—in the future? Ken Williams considers several areas: education, entertainment, and productivity, while Peter McWilliams adds a fourth; aiding the disabled and handicapped.

COMPUTERS AND HUMAN EVOLUTION/ MICHAEL CRICHTON

Michael Crichton, born in Chicago in 1942, was educated at Harvard College and Harvard Medical School. His novels include The Andromeda Strain *(1969),* The Terminal Man *(1972),* The Great Train Robbery *(1975),* Eaters of the Dead *(1976), and* Congo *(1980). He also wrote* Electronic Life *(1983), a non-technical introduction to computers. His books have been translated into 18 languages, and five have been made into films.*

Crichton has himself written and directed four feature films: Westworld *(1973),* Coma *(1977),* The Great Train Robbery *(1978), and* Looker, *(1981). A new film,* Runaway, *is scheduled for release in December 1984. Crichton, who lives in Los Angeles, CA, likes scuba diving and hiking; his collection of modern American art was recently exhibited at universities in Southern California.*

In Nepal today it is possible to hire a man or a donkey to haul a load over narrow mountain trails. Both beasts can carry about the same weight—roughly sixty pounds—for about the same cost—roughly two dollars a day. I mention this odd fact because it is so anachronistic. Westerners sometimes find it slightly shocking to learn that somewhere in the world men and animals still compete for the same jobs and the same wages. It's, well, inhuman. Isn't it?

Yet before the Neolithic era, some 7000 years ago, men were the only beasts of burden. It was during the Neolithic that domesticated animals were bred and tamed, and human beings ceased to define themselves as creatures that carried loads. The replacement of men by trained animals must have happened gradually, and if people were shocked or upset by it, they have left no record for us, some six thousand years later.

Indeed, we would have trouble conjuring up sympathy for any Neolithic man who wanted to put a stop to this trend of replacing people with pack animals. From our vantage point, such work is best suited to animals; we think of a man as having greater potential than that. As far as we are concerned, the only reason for a man to do physical labor is because the job is in some way too complex to assign to an animal.

But if you substitute "machine" for "animal" in the statements above, you can quickly provoke an argument. For one thing, the replacement of human activity by machines is much more recent, only a couple of hundred years old. For another, machines are taking over more than just backbreaking labor. They are taking away skilled tasks—and even intellectually skilled tasks—as well.

We have had centuries to become comfortable with the idea of letting animals pull the plow and to acquire bolstering prejudices against manual labor. But today, in less than a generation, we are starting to see machines that can, for example, read an X-ray as skillfully as a trained physician—and perhaps better. In many segments of society, these machines are producing extreme discomfort that has nothing to do with losing a job; it has to do with ideas of what is proper for human beings to do, and indeed what human beings are. Reading an X-ray is not a

> *We would have trouble conjuring up sympathy for any Neolithic man who wanted to put a stop to this trend of replacing people with pack animals.*

brutish task. It just isn't. And yet a machine can now do it.

And when you show up in the Emergency Room with a broken leg at 2:00 a.m., the machine is there; it doesn't have to be called in or awakened, and it will read your X-ray just as freshly as it would have that morning, or the day before. If you have ever worried about these things or had to wait in pain, you may find yourself guiltily preferring the machine over the poor human radiologist who is now out of a job.

These considerations suggest that at every level, the competition of man and machines will not be as simple as most people anticipate it will be. We have already seen some groups of people rather eagerly taking up computers; writers are a clear example. It turns out that nearly everyone who writes and types has no affection for the tasks of rewriting the retyping. A machine that makes those jobs easier is quickly embraced.

Indeed, I think it is most striking to see the wide range of people who are becoming involved with computers with no particular clear goal or need. After some thought, I have concluded that they sense that the computer can do for them what the computer has done for writers and for some businessmen. It can free them from being intellectual beasts of burden, from doing repetitive, tedious, mundane tasks.

In fact, I would argue that it is a force of human evolution, opening new possibilities for our minds, simultaneously freeing us from drudgery while presenting us with a parody of our own rational sides. Computers actually show us both the benefits and the limits of rationality with wonderful precision. What could be more rational than that pedantic little box that keeps saying SYNTAX ERROR over and over? And what does our frustration suggest to us, in terms of other things to do and other ways to be?

The possibilities are limitless. ■

GROWING UP/ ADAM OSBORNE

Known for his bold, controversial analyses of the computer industry, Adam Osborne has achieved national prominence as an entrepreneur, author, lecturer, computer industry analyst, and corporate executive. His first independent venture was Osborne and Associates, a programming, consulting, and technical writing company. With the publication of Osborne's book, An Introduction to Microcomputing, *Osborne and Associates became a leading publisher in the computer field.*

In 1979, Osborne sold his publishing company to McGraw-Hill and in January 1981 founded Osborne Computer Corporation. Although OCC had an unparalleled rate of growth, a delayed public offering and changes in key management personnel eventually forced the company out of the market. Osborne's newest company is the Software Seed Capital Corporation.

For any industry, its infancy is always the most exciting time. Just as the child experiences its world so much more vividly than any adult, so in a new industry every experience becomes much larger than life. Perhaps it is because, in both cases, the environment is so small that the small becomes significant, in particular, when populated by characters whose very lack of inhibitions lead to this corporate playground.

For the key formative years of the microcomputer industry I was an amused and often bewildered observer of the emerging microcomputer industry: Watching from my vantage point as I wrote my column, "From the Fountainhead." It was a superb listening post. From this vantage point I heard from Mr. DeMears, who relentessly pursured a certain microcomputer kit manufacturer for well over a year, during which time the manufacturer confessed that they simply did not have the thousand dollars that would have put their adversary at ease. And yet, this same company was bidding for a leading role in the emerging industry. It was also from my listening post that I suddenly heard about a new 6502 based microcomputer, receiving nothing but praise, which was called the Apple I.

Few of the original pioneers are still around today, and most of those who are survived by getting acquired.

It was inevitable.

Corporate America can not afford to participate in every wild eyed scheme or emerging fad on the off chance that the fad is, in fact, a new industry in the making. They have to leave infant industries to the misfits and the adventurers. If the infant industry is, in fact, destined to grow, market forces will make this apparent soon enough. As occurred in the microcomputer industry, the validity of the product overwhelmed the incompetence of the participants, and the industry grew. Once it became clear that the microcomputer industry was going to be big, very big, the giants moved in. No longer are MITS and Imsai doing battle, or even Apple competing with Commodore. Next year it will be IBM versus AT&T. It is a giant industry, and the giants have taken over.

One may mourn the passing of the early stages of the microcomputer industry, but for American industry at large, the model is amazingly effective. No other economy gives inventiveness and stupidity so much free reign. No other economy, therefore, breeds so much unlikely success. And always waiting in the wings are the traditional segments of the economy waiting to identify the winners and pick up their success when they can no longer carry on. Perhaps this amazingly efficient system developed by chance, but America should be proud of it because it has done so much for our economy. ■

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HOW WE TRAPPED THE DINOSAURS/ LEE FELSENSTEIN

Born in 1945 in Philadelphia, PA, Lee Felsenstein attended the University of California at Berkeley, where he was active in the Free Speech Movement. In 1964, he was arrested with 755 others during the Sproul Hall sit—in. He worked for the Berkeley Barb *and the* Berkeley Tribe *weekly newspapers. He received his B.S.E.E. from UCB in 1972. In 1974, Felsenstein published (as LGC Engineering) "The Tom Swift Terminal, or a Convivial Cybernetic Device," preliminary specifications for a personal computer.*

In 1975, he was a founding member and meeting moderator for the Homebrew Computer Club. He was West Coast editor from 1977 to 1978 for ROM *magazine, which was later purchased by* Creative Computing. *Felsenstein designed the Osborne 1, the Sol Terminal, and the Expander computers, as well as the Pennywhistle 103 Kit Modem and the VDM-1 Video Display Module.*

Remember the wrist computer on the astronaut's arm in *2001 A Space Odyssey*? With it its prominent IBM logo (in solar-wind resistant titanium oxide, obviously) it was the corporate Establishment's subliminal promise of the great future that was to come—as long as we let them have a free hand. Just imagine, wrist computers! Pretty heady stuff it was for 1967.

Many of us were then starting to shed our adolescent views of technical development as we moved from the educational system into the lowest levels of the production system. Many of us quickly noticed that our noble managers knew less about the technologies with which we were working then we knew. We also started to see that the business of Business was making money, not products, and that if they could make money with turkey products then we would be put to making turkey products and nothing else.

And we discovered that the Big Boys of the computer industry were not after all engaged in a race to get the best computers to the most users at the lowest cost but were instead playing marketing muscle games to lock in the biggest proportion of users to the highest cost computers possible. It began to remind us of another big movie of 1967, *The President's Analyst*, in which a new superpower is discovered to be the Phone Company, with evil designs for exceeding the plots of any mere nation.

So we did the only thing we could under the circumstances. We learned as much as we could about our technologies and kept alive our sci-fi dreams of a future when *everyone* could have a computer, and no one be locked out of all the fun and fascinating things we knew could be done with computers.

Never mind that those things were not very well thought out or that most people didn't consider them fun. We hadn't spent all that time learning all that stuff because someone had asked us to. It had a beauty all its own which we could understand and which we wanted to share with everyone. This was a basic artistic impulse which is expressed wherever people live.

Sharing the News

There were a few means of newsletters like *People's Computer Company* and small magazines like *Creative Computing*. Through these we discussed game software, hardware like Don Lancaster's TV Typewriter, Carl Helmers' Experimenter's Computer System ESC-8, and the Mark 8 8008 computer kit. We read, or at least pored over Ted Nelson's *Computer Lib/Dream Machines*, extracting as many nuggets of computer science as we could handle.

I was fortunate enough to participate in a public access computer project which demonstrated graphically, to me at least, the absolute need for and effectiveness of personal computers. In my view a public access computer system would not be feasible until every piece of computer hardware in it had a computer club about it. Then, or so I theorized, the problem of a centralized maintenance and support structure would be solved. I began to do my duty as an engineer in 1974 by defining preliminary specifications for the kind of hardware I thought would qualify as honey for that kind of bee. I called the concept the Tom Swift Terminal and distributed a mimeographed description.

Then, with the sudden ferocity of events overtaking the dreamer, we were in the midst of the explosion.

> *Thousands of people sank their own money into learning about computers in the hardest and best way—by trying to build or program them from elements which were barely adequate at best.*

Advent of the Altair

When Altair 8080 Computer Kit appeared in January 1975 we scrutinized the diagrams in the article, discovering that it was a simple design that had obviously not been finalized. In March the first sample arrived in the San Francisco area, and the Homebrew Computer Club galvanized around that unit (serial number 8). A bus structure, no I/O available, more

money needed, software of all sorts essential—this was raw, standardized opportunity. And nobody was looking! We could do anything we wanted to.

What happened in those "unforgettable next two years" (as Ted Nelson presciently called them in a 1976 address) was that thousands of people sank their own money into learning about computers in the hardest and best way—by trying to build or program them from elements which were barely adequately at best. Hundreds of people became sufficiently involved in attempting to produce new hardware and software that they became participants in a kind of group sport. Like athletes, they strove to do what had never been done, to exceed their known limits and to share their success and efforts with each other in the hopes that all would gain. The reward was triumph, not money.

It is this atmosphere of design as sport that I consider to the most important aspect of the early microcomputer days. The parallels are not exact, but I compare it with what I know of the early days of aviation. The people who created this atmosphere capitalized it themselves, so they were not subordinate to money men. They made many blunders, companies started and folded on a shoestring, but the people involved kept coming back for more, and in this way they formed the infrastructure of the microcomputer industry.

We ran ahead of the lumbering giants of the computer industry and frantically staked out our territory. We learned as pioneers must to rely on each other for support. When the dust cloud neared and the dinosaurs hove into sight we were prepared—and we prevailed.

In 1978 IBM put its foot over the line and said "that's mine" with the 5100, a breadbox-size wonder of incompatibility that epitomized The IBM Way. They don't like to talk about what happened to them. In 1981 they returned with the 5150 (the PC) and with it they followed the rules we had laid out. Anyone can play, these rules read, but you must make your architecture and executive code as public as possible, and you must encourage individuals to write programs and create add-ons. You can play games, but you must help others to play as well.

We didn't give the corporate Establishment free rein in the hopes that they would bless us with innovations. We trampled all over their organized ways of doing things. It was a lot of fun, and I think it can be done again, where technology can be implemented on a small or intermediate scale by people who treat it as an art and a sport.

As an early *Mad* magazine quipped; "fools rush in—and get the best seats!" ■

WHAT MAKES A COMPUTER PERSONAL?/ P.D. ESTRIDGE

Philip D. Estridge, usually called Don, is president of the Entry Systems Division of IBM. He holds an EE degree from the University of Florida (1959) and joined IBM upon graduation. He came up through the ranks at IBM and was involved in several design and development projects before joining the developmental project facility in Boca Raton, FL in 1969.

Thousands of articles have been written about the remarkable growth of the personal computer industry. By and large, those stories have dealt with systems, options and ways to use personal computers and, in general, it would seem that hardware and software continue to be the stars of the show, the factors driving the tremendous acceptance of personal computing.

In many ways, the strength and potential of personal computers begin with machines and programs and the rapid-fire development of new systems, options, and applications. But these factors are only the beginning. The key ingredient in the growing acceptance of personal computers is their consistent focus on the person using them.

The reason they are called *personal* computers is that there is no "one size fits all" in personal computers. Each person is unique, and has different needs, habits, income and desires. It is the element of choice that personal computing offers to people that ensures the continuing appeal and acceptance of personal computers.

It is choice, for example, that is the underpinning of IBM's commitment to open architecture: providing information and specifications which encourage others to develop options and programs that run on our systems. This approach has enabled hundreds of companies and individuals to develop hundreds of hardware peripherals and thousands of applications which people can choose for their IBM Personal Computers.

Compatibility is also extremely important. It means that much of the software already available for IBM Personal Computers is immediately available to those buying a newly introduced IBM system. That helps protect the investment made by those who developed the applications. It means consumers buying a newly introduced IBM system can choose from an existing library of thousands of program applications. It protects the investment that people buying a second system already have made in software and hardware. It means individuals using different IBM Personal Computers can share programs and information either electronically with a cluster or modem, or simply by exchanging work disks. And it allows those familiar with one PC model to start using another model quickly and easily.

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tor, and is defined as how easily a person can start using a system or program, and how easily that person can expand the way the system is used. One of the surprising aspects of personal computing for many people is that, while they bought a PC primarily to do one job, they soon discover that it will do many. They realize that the productivity it gives them in writing letters and reports, for example, is easily carried over into managing a budget, tracking investments, organizing files, and many other personal, business and educational activities.

Variety, flexibility, and ease of use have given people the technological tool to let their creativity flow; to give free rein to their imagination; and to use the power of the PC to change and improve the way they use their time and energy at home, in business, and in school. Personal computers give people new tools with which to learn, to develop skills, to expand their potential, to make everyday routine tasks easier, and to focus their energy in areas that improve their lives. The thousands of applications available for personal computers are an indication of the many things people can do now that were not possible without a PC; but the true potential offered by the personal computer lies in the many functions that remain to be discovered.

One of the most exciting aspects of the personal computer is that tomorrow's discoveries may not come only from today's developers. The personal computer has made the power of the computer available to almost everyone in nearly every walk of life. They are being used in accelerating numbers by people of every age, in classrooms at every rung of the educational ladder, in homes around the world and in nearly every area of business, science, medicine, the arts, and education. Wherever they are being used, people are taking advantage of the potential personal computers offer to them to better manage information and broaden their horizons.

The personal computer industry cannot achieve that potential alone. However, it can provide the technology and make it easy to use and readily accessible so that systems and applications can be combined with the creativity and imagination of those using personal computers. With that combination, there are no limits to what changes can take place to improve all our lives. ■

THE GREAT PERSONAL COMPUTER CON/ TIM HARTNELL

Tim Hartnell is a 33-year-old Australian who spends about half his time in his home country, and the rest in the States and England. He first became acquainted with computers when he bought a ZX80 and founded the National ZX Users' Club in England. He taught himself to program and wrote his first book Making the Most of Your ZX80. *A second book on the ZX80 followed, and a third; soon he became a one-man writing waterfall. Some 40 books on personal computers (he's unsure of the exact number) have now been published around the world, supporting his claim to be the world's most widely published computer author. One of his books,* Mastering Your Timex Sinclair 1000 *became the top-selling computer book in the U.S. for two months last year. When the shouting dies down, he would like to become a pop star so that he could have a bit of a rest.*

It may be harsh news, but those who market personal computers have been conning us for years.

Be honest. What do you *really* do with your personal computer? I don't mean the things you tell people when they ask (so you can disguise the fact that every disk you own is filled with bootleg copies of games like *Space Gobbler* or *Smash Hell Out of the Alien*), I mean the things that you actually do.

Several times I've been interviewed regarding personal computers and inevitably (after the obligatory question "Are computer games leading us to raise a race of people who can solve problems only by blowing up their opponents?") the wise interviewer will say, "Well, I've thought about it, and there is nothing I can see that I would use a computer for at home."

And when I thought about it seriously, I realized that I didn't have much idea of what people really did with personal computers or why they bought them. I know what the marketers of personal computers *say* you can do. And this is where the con comes in.

There are two main approaches they use. The first one runs like this: "Buy a computer or your child will be hopelessly left behind at school and will be handicapped for life." I reject these claims absolutely because (a) they attempt to arouse parental guilt and feelings of inadequacy; and (b) because they are just plain lies. This direction can hardly, to my mind, be one in which the answer to "what do you need a personal computer for?" can be found.

The second main way to sell personal computers seems to be the "use the computer as a Gee Whiz Aid around the house." Balance your checkbook on it, store recipes on it, catalog your books.

In *Time* magazine last year, the results of a survey of owners of personal computers were published. The results showed that 49% of those surveyed *claimed* they used their computers for "balancing their checkbooks." Bunkum. I suggest the people who drew up the survey questions and analyzed the results should have been a bit more critical. I bet that nearly all (if not all) of the 49% ticked the "balance my checkbook" box because they didn't want to be seen as someone who

it all adds up...

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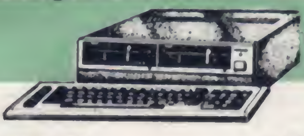

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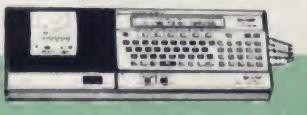

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CIRCLE 118 ON READER SERVICE CARD

"just plays games."

It seems to me that many of the reasons manufacturers give us for buying a computer are either lies or are so utterly irrelevant as to suggest that those drawing up the advertising don't have a clue as to what the products would be used for.

What do *you* use your computer for (or, if you don't have, one, what do you think you would use it for)? If you are like most of my computer-owning friends, you spend a lot of very satisfying time just "mucking about" with it—writing programs, typing in stuff out of books and magazines, expanding your programming knowledge, playing with commercial software.

As well, you may use it—as more and more people appear to be doing—as a word processor for letters and reports, or for keeping control of a mailing list for your club. However, I'll bet you spend most of the time just "mucking about" with your computer.

People don't ask, when they see your car in the driveway or notice an electronic organ in your home, "What do you do with it?." You feel you are entitled to have a musical instrument to muck about on, with no intention of giving a concert at the Lincoln Center, and you can drive for pleasure without feeling you must one day be a racing driver or drive a cab around town. Why should a computer be different?

It is the quintessential toy. It is an infinite passageway that can lead you and your mind just about anywhere

> *I'll bet you spend most of the time just "mucking about" with your computer.*

you choose. You do not have to use it (or feel you must defend why you are not so using it) as a poor substitute for a stack of file cards or a calculator and the back of an envelope. When Faraday was asked the use of that newfangled stuff "electricity," he turned the question back on the enquirer by saying "What's the use of a newborn baby?"

The personal computer is still a newborn baby. We are still at the horse and buggy stage of computing. At present, computers are pretty dumb and in need of constant direction.

And here's where the "telephone" of the title comes in. I believe that fairly soon (within six years) computers will be much like present day telephones.

You don't need an instruction book or a four-week course to use the telephone. You see someone do it or you have 12 seconds of instruction and you can use a phone for life.

This will happen with computers. And when it does, when you can just get one, talk to it and get it to talk back to you and do what you want it to do without hassle or misunderstanding, the personal computer will really have arrived. Once it has come to this, no one will ask "Why do you need one around the house?"

Until the era of the Hartnell Telephone-Like Computer, there is just one way to answer those people who want to know what use a personal computer can possibly be. Assume a sage-like expression, raise one eyebrow like Mr. Spock about to go boldly where no man has been before, look fixedly at your enquirer, and ask softly "What is the use of a newborn baby?" That'll shut 'em up. ■

BRINGING MANAGEMENT SKILLS TO MICROS/ WILLIAM GODBOUT

William J. Godbout has been involved in the computer industry since 1959; while at IBM his experience spanned the transition from vacuum tubes to transistors. After completing military service in 1967, he founded Godbout Electronics. Having worked with microprocessor technology since its advent, in 1973, he established CompuPro of Hayward, CA as a manufacturer and supplier of microcomputer components and systems.

Godbout, a nationally recognized authority on the IEEE 696/S-100 bus standard, has designed several microcomputer components and systems.

The use of microcomputers in daily business operations gives managers direct, local control over information resources that is impossible when dealing with a mainframe maintained by "high priests" in a data processing department.

The real value of microcomputers in the workplace is in the amplification of *individual* human effort and human skills, raising the individual's productivity by improving his creativity. Increased productivity is vital to bringing about the reindustrialization of the U.S. and its conversion from a "smokestack society" to an "information society."

One of the ways to speed this conversion to an informattion society is by developing a matrix of management skills within which to employ microcomputers, workstations, mainframes, communications, networks, and all the other rapidly developing electronic tools available.

The result may be the redefinition of information management. And the time is right for bringing this new management matrix to bear on microcomputers in the office. There now is a window that is no more than 24 months open which will allow for a great deal of creativity and innovation in management science and skills, es-

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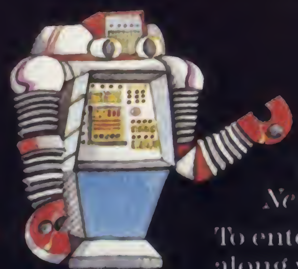

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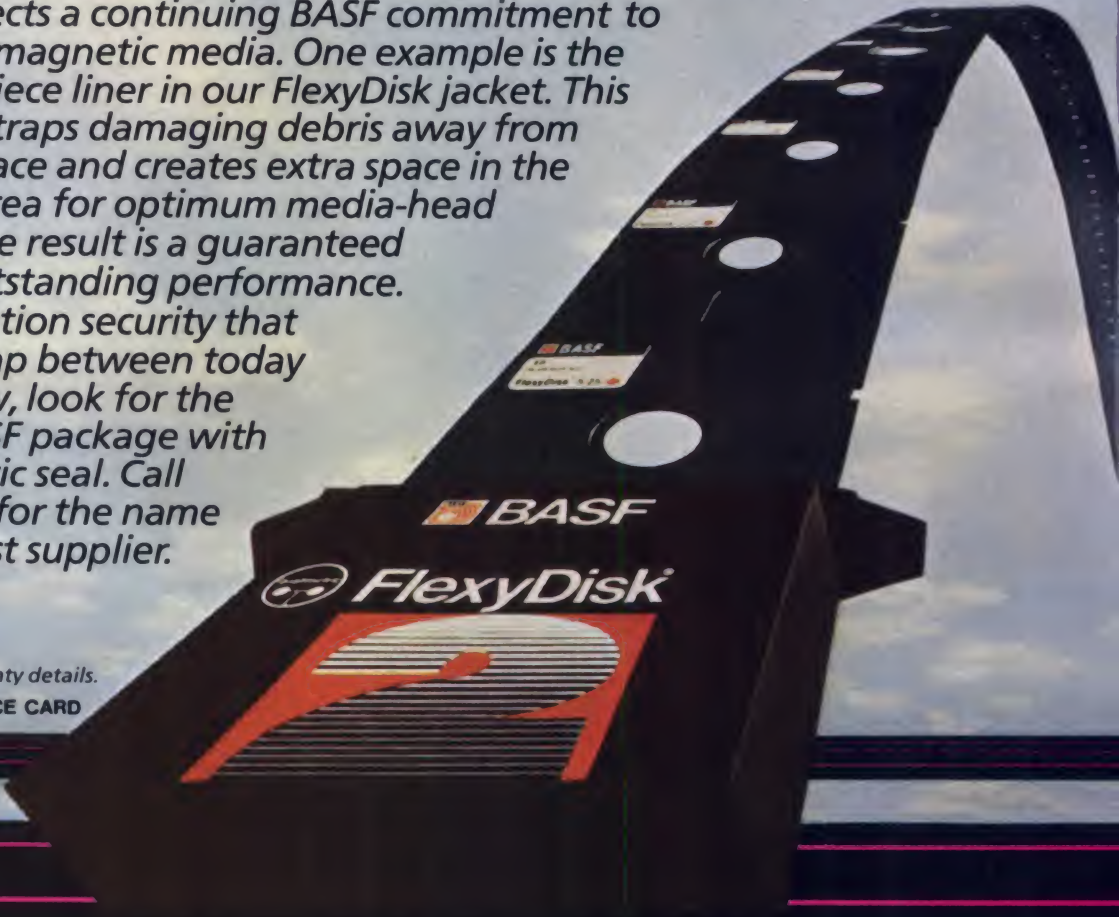

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pecially as they apply to the use of new electronic tools. After that period, the manager who has not taken advantage of the options now available may find those options no longer exist.

The "Single Guru" Trap

The first key point in applying management skills to microcomputers in the workplace is realizing that these capable machines are *everyman's tool*, not just the wards of the DP department. If a manager starts developing another cult of high priests around microcomputers from a user's standpoint—the true application standpoint—the effort will fail. There will be so much overhead that a real cost/benefit analysis will prove that the value of having local computing resources will be lost.

The first key point in applying management skills to microcomputers in the workplace is realizing that these capable machines are everyman's tool, not just the wards of the DP department.

Those "everyman computers" now exist and they are getting better, faster, and more capable every day. The improvement of work output through such tools as scientist/engineer workstations, dedicated administrative workstations, computer-aided design, graphics and manufacturing computers, and many other "desktop" applications is evident, even at this beginning stage of microcomputing in the workplace.

More than one project involving the employment of microcomputers has failed because the management approach was to make it a single designer project. The single guru was put in charge of all aspects of what was essentially a multi-designer project. That stifled creativity at the start, prevented synergy and interaction along the way, and inevitably invited failure when the single guru reached his level of incompetence or even worse, somebody made him an offer he couldn't refuse and he left. This is something a manager cannot allow to happen.

What Micros Cannot Do

The second key point for managers to realize is what the single microcomputer—or even groups of stand-alone or networked micros—*cannot* do. In management of any project, administration and reporting are key requirements. General purpose micros, running word processing software, meet those requirements very nicely.

Another general requirement is "modeling," whether it is accomplished through physical models or mathematical models and computer simulation. At certain levels of modeling requirements, general purpose micros using spreadsheet kinds of software with the capability to make rapid "what-if" manipulations are very satisfactory.

The major problem in those three key areas—administrative reporting, modeling, and communications—is that no manager today can pull a plain vanilla general purpose microcomputer off the shelf, drop it on a desk, and say, "This will do your word processing, modeling, and number crunching and handle all your communications." That machine does not yet exist, and may never exist, though it is a machine that all of us manufacturers are trying to build.

What is more likely to happen is that a general case solution will involve microcomputers and workstations that will satisfy about 80% of all engineering, administrative, scientific, and business applications, at the individual's desk under his total and local control.

But the other 20% will be met by the capabilities of highly specialized machines with rigorously optimized hardware and software that makes them ideal for highly specialized control tasks, guidance tasks, database management, program development, and special types of administrative and management tasks. However, those machines are basically unsuitable for general computing.

When a task calls for dealing with a huge database, a medium-sized general purpose microcomputer will not meet the requirement. If large matrix inversions are necessary, a desktop business computer will not do the job.

The management skill enters in that 80th percentile. The best manager will know enough to ask the question, "Do we go with a piece of general purpose hardware, marry it to some software, bash it together to fit, then paint it to hide what we've done?" There are times when to answer, "yes" to that basic mangerial question is the right decision.

But there are probably many more times when bashing-to-fit and painting-to-hide are far more costly than installing special purpose hardware and software. A large econometric modeling program running on high speed, number crunching hardware is an example that comes to mind.

Summing up those two key points in the managerial question, the person charged with deciding to install microcomputers must be able to answer, first, the question, "Can we use electronic equipment as an amplifier of *individual* human effort in this application?" And if the answer is yes, he then must be able to decide, "Can it be done with a single microcomputer, or will we need additional special and dedicated hardware and software?" Thankfully, managers are not faced with those decisions daily.

Managers charged with bringing micros into the workplace have a great opportunity in the next two years to do it right.

Managers charged with bringing micros into the workplace have a great opportunity in the next two years to do it right. There is enough experience with micros to avoid the time-consuming and extremely expensive mistakes of the early '80s. There is enough solid direction from industry leaders to make very good estimates of where the future lies (16-bit machines, CP/M, and CP/M look alike operating systems, 327x communications protocols), and there is enough actual experience

already in the workplace to provide a history of what works and what doesn't.

Now it is up to the managers to superimpose on that rapidly expanding body of knowledge and hardware their own styles of management expertise, which must include the avoidance of the single guru trap and educating individuals in the best ways as to the use of microcomputers.

The result? Dramatic increases in worker productivity through extension of each one's unique abilities. ■

WHERE WE'VE BEEN; WHERE WE'RE GOING/ DAVID TEBBUTT

David Tebbutt joined the computer industry almost 19 years ago after a varied five years that included selling newspapers on the Champs Élysées in Paris, designing cardboard boxes, selling men's wear in a chain store, and running an ice cream van. He has programmed computers, designed systems, installed and managed several installations, and taught management skills.

He has become best known for his editorship of Personal Computer World, *Britain's leading microcomputer monthly, for Caxton Software of which he is a co-director, and for the design and co-authorship of* BrainStorm, *an idea processor. He is still closely involved with several British microcomputing journals and writes regularly for two of them,* MicroScope *and* Personal Computer World. *Married with three children, he edits Mensa's* International Journal, *yet somehow manages to stay reasonably sane and happy.*

First of all, congratulations to the gang at *Creative Computing* for reaching this wonderful milestone. Twice in my recent career *Creative* has been directly responsible for helping me clarify my thoughts on a new project. When I was thinking it was time Britain had a decent microcomputer magazine, there was *Creative Computing* fully-fledged and setting a splendid example to those who followed.

The nice thing about *Creative* is its friendly yet respectful approach to its readers. I figured that if I could capture the same spirit in what became *Personal Computer World*, I would have achieved much of value. *PCW* went on to become Britain's biggest-selling microcomputer magazine, so I guess we did something right.

The next time *Creative Computing* directly affected my career was a couple of years later when I was struggling to find a way of holding models of the human brain in the computer. I was still editor of *PCW* at the time, and *Creative* ran two issues featuring actor languages. Something about the ideas expressed gave me confidence in what I was trying to do and, to cut a long story short, I eventually by-passed the traditional AI languages and wrote *BrainStorm*, an idea processor, in machine code. It was almost as if *Creative* had given me permission to go right ahead and do something weird. I believe Ted Nelson was the man responsible, and for that I thank him.

A number of my projects have benefitted greatly from other people's inputs. For example, I inherited a computer show with the magazine and, frankly, the first year I was involved it just didn't feel right. Shortly afterwards I found myself at the West Coast Computer Faire which seemed to have exactly the flavor I needed for my own magazine's show. I met Jim Warren and all his staff, absorbed the unique atmosphere surrounding that show, and tried to take it back to Britain. Once again I ended up with a very successful show. It actually overtook the West Coast Faire in number of attendees after about three years.

Another thing I got going in the UK was Computer Town. At the time we launched this, the government was doing very little about computer literacy, and Clive Sinclair had only just got going with his first proper computer. Over in California Bob Albrecht and Ramon Zamora had a scheme going in the Menlo Park library whereby members of the public could just drop by and learn about computers free of charge. Qualified people could drop in any time and use the machines. Those new to computers had to come by at particular times when trainers were around to help out.

Three, people motivated me to bring the scheme to England, Bob Albrecht, Ramon Zamora, and Judy Lower. I think Tom Williams, one time editor-in-chief of *InfoWorld*, deserves thanks too as the man who plugged me into that particular loop in the first place.

I'm OK . . . You're OK

The people I have mentioned are just a few of those who have helped me over the years. I'm sure that all people who get on in life can only do so with the help of others. After all other people are your bosses, your subordinates, your customers, your suppliers, your family, and your friends. Whatever else happens in life, there will always be other people around.

> *Whatever else happens in life, there will always be other people around.*

It makes sense, therefore, to develop interpersonal skills so that your interactions with them are as reward-


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CIRCLE 198 ON READER SERVICE CARD

ing as they can be for both parties. I was lucky enough to realize that my skills with other people were less than adequate, so I took up teaching for a couple of years.

It was during this time that I was introduced to the work of a number of behavioral psychologists. Eric Berne, in particular, impressed me with his theories of Transactional Analysis. All sorts of books have been written on this subject but a good starter is *I'm OK . . . You're OK* by Thomas Harris. This idea of analyzing each verbal exchange was a tremendous help to understanding myself and other people.

I found that as I carefully monitored the way I behaved, other people began to behave differently and most conversations and discussions became far more rewarding as a result. I guess I was lucky because I had two years or so of continuously practicing these newly developing skills on my students. By this time I found that TA had become second nature.

A few things I have tired to scrub out of my behavior repertoire are guilt, bitterness, regret, worry, and blaming others. It is not possible to succeed 100% in banning these feelings, but at least by recognizing how fruitless they are, I have minimized them. Guilt is simply worry about something that has already happened and therefore cannot be changed. It is important to learn the lessons the past can teach but not to dwell on it after the lessons have been extracted.

Bitterness and regret are similarly fruitless and can sour your chances of future success if they are allowed to become part of your personality. Worry is even worse because it usually concerns something that hasn't even happened! The energy spent worrying would be better spent trying to minimize the effects of whatever it is you are worrying about.

Blame is a bit like guilt. You and the person you are blaming can both derive some sort of lesson from what has happened, and that's about it. If the person is in some way subordinate to you, then you should take responsibility and attach any blame, if you must, to yourself.

It's Never Too Early

I have always been a bit of a loner. I tend to think my own thoughts and not follow the crowd. Only in this way can I hope to latch on to things early enough for them to give me fresh directions. If I had waited until microcomputers or software hit the big time, I would have found the cost of entry and the competition in both magazine and software publishing too horrendous to contemplate.

As you saw earlier in this article, *Creative Computing* is a great source of ideas ahead of their time and one of them could be your great opportunity. Look for the weird articles, the speculative ones, especially the ones that catch your imagination. Don't think that because something has appeared in print that it's too late to jump on the bandwagon or that there is even a bandwagon to jump on. The article could simply spark something off like Ted's actor language stuff did for me. People who get up and do things are in the minority. As long as you are one of the first few to do something new you stand a good chance of succeeding on a reasonable budget.

Don't think that because something has appeared in print that it's too late to jump on the bandwagon or that there is even a bandwagon to jump on.

Once upon a time in this industry you bought a computer because it did what you wanted at a price you could afford. Nowadays, people are increasingly buying computers because marketing people have gotten at them. Never mind that they don't have an application for the machine. "Everyone is getting one, therefore I must get one too" is the underlying trend.

There is a certain inevitability about the purchase of a computer that is wonderful news for manufacturers, software publishers, and the like, but it seems to be fraught with built-in problems for the buyers. Marketing is becoming the key factor in the decision to purchase.

Computers are being packed with features just like motor cars before they started sprouting radios, cassette players, alloy wheels, two tone trim, and so on. Some companies, afraid of being left behind in the "windows" race are offering color. Never mind that it has no relevance to many applications, frequent color changes in the most ordinary software are required to persuade the prospect at a subliminal level that this is the right machine to buy. The suppliers of monochrome machines are suggesting that xerography has survived for 20 years without color so what's the big deal.

Apple has come up with a sweet little machine that has rather the same effect on the potential user that E.T. had on filmgoers. The desire to own a Macintosh has very little to do with what it can do for you in practical terms, although by now I'm sure it can do much. It is the sort of machine that you fall in love with in just a few minutes—surely a marketing man's dream.

No doubt by the time this article is published the Macintosh will have created a new form of addiction to join drugs, smoking, and alcohol. Productivity will probably plummet as people find they just can't stop playing with the darned thing. The rumor as I write this is that IBM is trying to jump on the 68000/icon/mouse bandwagon with almost indecent haste.

Fifth Generation Fruition

The future is going to be very interesting for all of us. There is a danger that barriers will go up between Europe, America, and Japan as our various Fifth Generation projects move towards fruition. It looks to me as if Britain, America, and Japan are on slightly divergent courses in terms of how their intelligent knowledge-based systems are to work.

I happen to think that we have some pretty neat approaches here in the UK. I'm sure that you feel the same about your own methods, and no doubt the Japanese are confident in theirs. If knowledge is to become the "fuel of the future," this poses some interesting problems for us all. We already see the seeds of some of these problems in the way software is being copied today.

I'd like to think that the Fifth Generation activity and the need to share knowledge through high speed international communications networks will lead to a global cooperation which will in fact break down the bar-

riers of suspicion that divide nations at present. The realist in me expects the world either to continue to be hopelessly divided or to polarize even more sharply into "haves" and "have nots" with the haves possessing a near monopoly on knowledge and the systems for manipulating it. ■

WHAT EVER HAPPENED TO PERFORMANCE?/ WILL FASTIE

Will Fastie is editor-in-chief of PC Tech Journal, *a technically oriented magazine for the sophisticated IBM small computer user. He is also a contributing editor to* PC *magazine and* Creative Computing *and is the original author of the "IBM Images" column in* Creative. *He received his computer science education at Johns Hopkins University, where he specialized in programming languages, methodology, and software quality.*

He spent ten years in software development at General Instrument Corporation, where he last held the post of director, advanced systems development; he was responsible for the design and implementation of operating systems, software tools, and microprocessor-based systems. Married with two children, Fastie lives in Baltimore with his family, two dogs, and an early serial number IBM PC.

We are told, over and over again at every opportunity that computer technology, specifically the computer technology the speaker is trying to sell us, has taken another giant leap forward. Although the claim is sometimes exaggerated for profit, it is nonetheless true; those computers sitting on our desk, whatever flavor or color they might be, *are* more powerful than the biggest computers of 30 years ago. For that matter, the *calculators* in our pockets and purses are more powerful than those monsters of three decades past.

Making this same claim for the ten years that *Creative Computing* has spanned is more difficult, but it is true as well. To see the improvement, however, it may be necessary to consider more complicated issues, such as the amount of work performed by computers ten years ago as compared with today, and the relative costs of each. To veteran readers of *Creative*, the answer is clear.

It is fine to know that we pay less today for more collective power. A more interesting query has to do with the power of an individual system today as compared with a similar computer of ten years ago. I find myself scratching my head on this one; although I could never have afforded the rough equivalent of my basement IBM PC back then (not to mention the cost of electricity to run it), I find myself longing for some of its features and functions and missing, oh so sorely missing, its power. And what has been bothering me is that I don't know why I can't have it.

Photo 1 (recently taken) shows a system equivalent to the one I used professionally for software development in 1974 when I worked for a division of General Instrument Corporation. It consisted of a Data General Nova 1200 processor with 32K words (64K) of *core* memory; two 45 inch per second (ips), 9-track, 1/2", 800 bits per inch (bpi) tape transports capable of handling reels of up to 2400 feet in length; one fixed-head disk drive storing 500K of data (within a year we had a whole megabyte!); and, as the 10 character per second (cps) console, the venerable Teletype model 33 KSR terminal, later replaced with the 30 cps DECWriter. We had three or four of these systems; one or two of them also had a 600 line per minute (lpm) line printer. Because the system was more or less equivalent to the configuration we sold, we could also use customer systems for development before they shipped, and we often did.

The system lived in a double-bay cabinet standing over six feet tall. It required about 12 square feet of floor space, not counting the terminal, printer, or access to the rear. The main power cable was 3/4" in diameter. Using 110-volt power, the system required its own 20-amp circuit. Even though the Nova had its own cooling fan, the cabinet included an integral ventilation system. The system operated with a muted roar.

At list, the system cost about $50,000. The printer cost $20,000. I have about $6000 invested in my IBM PC. A quick comparison of the two can be seen in Table 1.

The Author's Data General Nova 1200 system in 1974.

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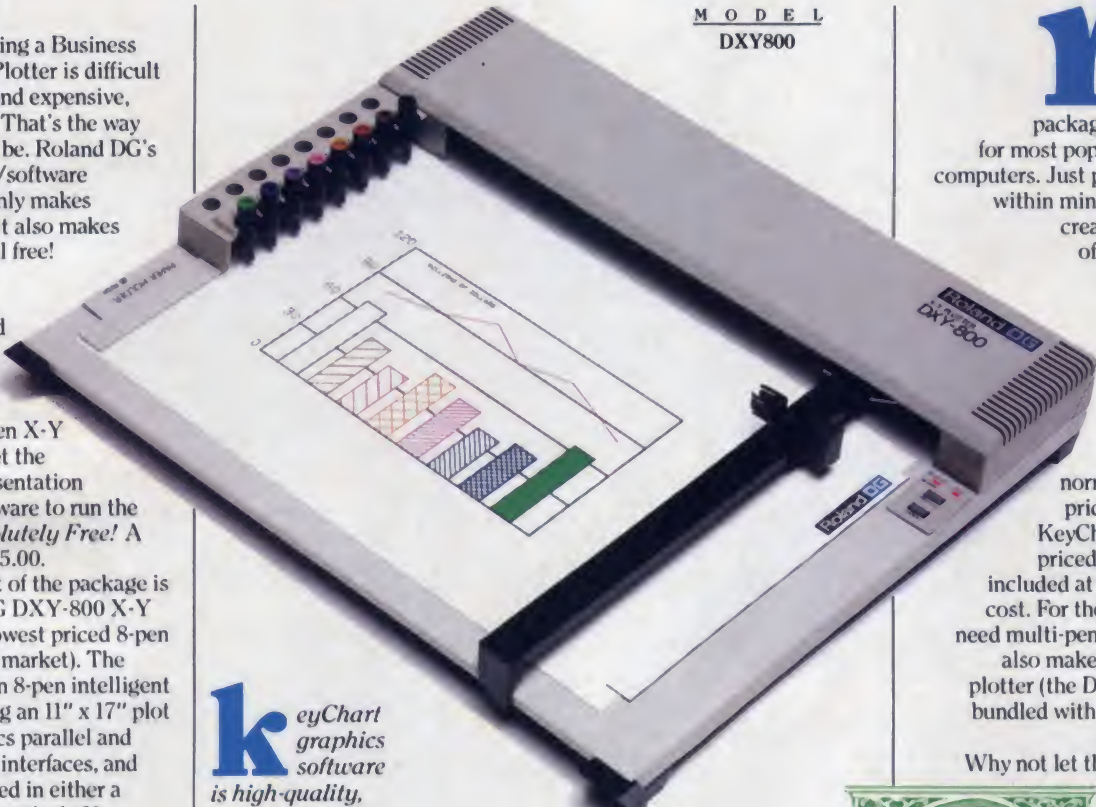

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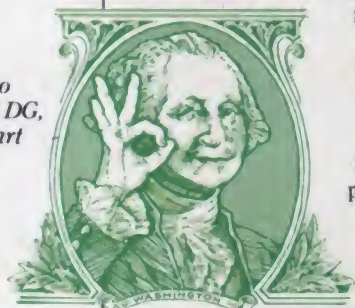

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Roland DG

Raw Power

The instruction execution times for my old Nova and my new PC are not by themselves enough to measure their comparative raw power. Nonetheless, we will try. Table 2 shows the execution times for a few typical instructions on the Nova, the 8088 in the PC, and a theoretical faster PC. (There has been some speculation that a new, 8088-based IBM PC/XT will operate at 8 MHz instead of the current PC's 4.77, or that an 8086-based machine will emerge.)

The Nova fares pretty well, especially in the memory access category. For most of the processing I am thinking about, the primary type of activity *is* memory access. for example, an assembler inputs source code and translates mnemonic codes into binary numbers, that is, executable instructions. Although something of an oversimplification, this activity mostly requires moving things around in memory as opposed to performing arithmetic calculations.

Today's software is not as optimized for performance as the more primitive programs I used on my Nova.

Overall, the 8088 chip running at IBM's 4.77 MHz rate is much more powerful. The instruction set is rich compared to the older, somewhat primitive Nova. For example, the Nova has no multiply instruction and no instructions to manipulate bytes. The 8088, on the other hand, includes powerful string handling commands, an assortment of memory access instructions, and other special features which combine to make an effectively written program quite powerful. At the bottom line, I consider the PC more powerful than my Nova of ten years ago, by a comfortable margin.

Yet, the performance of the PC is lacking. I find myself wishing for the Nova. What's wrong?

Table 1: Comparative System Configurations

	1974	1984	
Item	Nova 1200	IBM PC	IBM XT
Approximate Cost	$50,000	$4,000	$6,000
Mass Storage			
Disk			
Type	Head-per-track	Floppy	Hard Disk
Amount	.5 MB	.36 MB ea	10 MB
Tape	9-track, 800 bpi	2 drives	—
Maximum Memory	64K	640K	640K
Console Type	TTY KSR 33	CRT	CRT

Table 2: Comparative System Performance

		Today's PC		Fantasy PC	
Instruction	DG Nova 1200	4.77MHz 8088	Percent faster	8 MHz 8088	Percent faster
Move 16-bit word memory to register	2.55	3.15	-24	1.88	26
Move 16-bit word memory to memory	5.10	6.30	-24	3.75	26
Add 2 16-bit words register to register	1.35	.63	53	.38	72
Call subroutine	1.35	5.04	-273	3.00	-122

Note: All times in microseconds

Table 3: Comparative Program Sizes[1]
(All sizes in bytes)

Program	DG NOVA Name & Size	IBM PC[2] Name & Size
Operating System Kernel	SYS.SV (13000)	IBMBIO.COM (1920) IBMDOS.COM (6400)
Command Processor	(included in kernel)[3]	COMMAND.COM (4959)
(Total OS)	13000	13279
Assembler	ASM.SV (8748)	ASM.EXE (52736)
Linker	RLDR.SV (11776)	LINK.EXE (41856)

Notes:
[1]All sizes in bytes.
[2]Figures for IBM DOS 1.1
[3]The DG command processor included many commands that are separate programs under IBM DOS 1.1, such as COPY, TIME, DATE, and others. DG DOS also included many IBM DOS 2.0 features; For example, PRINT.COM alone is 4608 bytes.

Comparable Software?

What's wrong is that the software of today is not as optimized for performance as those more primitive programs I used on my Nova. They are also not as small. The facts of the matter are presented in Table 3.

Why has this happened? Why are the new programs neither as fast nor as small as their older counterparts?

There are several reasons. The newer IBM PC has considerably more memory resources than the Nova. Nature abhors unused main memory, and programs grow accordingly. Associated with this fact is that most of the tools of today are written using high level languages. These languages gen-

erate moderately efficient code that is nevertheless far from optimal.

In sharp contrast, the program writers of ten years ago had no high level languages with which to work. In addition, main memory was so expensive ($80,000 per megabyte vs. $3000 today) that many systems were configured with less than the maximum supported. Even in such tight systems, the basic tools had to operate. Amazing as it might seem today, the complete assembler occupied less than 8000 bytes of memory and ran faster than a speeding bullet.

I think it may also be fair to point out that the assembler writer pored over that code for a long time, tightening things up, finding faster or cleverer ways to do things, and generally optimizing the bejabbers out of the program. Today, I suspect the major consideration is to get the program written as quickly as possible and working to a specified level of functionality without over-abundant concern for speed of operation. Programmers are expensive, more expensive than the computers upon which they work. That is a reversal from ten years ago, and it may account for the change.

What ever happened to performance? I guess it just got lost in the shuffle. If I see it again, I think it will be the result of ever more powerful hardware and large chunks of cheap memory; tightly written, highly optimized code seems to be a thing of the past. ■

WHO'S IN CONTROL?/ PETER RODWELL

Peter Rodwell has been closely involved in the micro world since it first took off in the UK. Trained as a journalist, he worked on newspapers and in corporate public relations in the UK and South America for 10 years before getting involved in computers. Until mid-1983, he was the editor of Personal Computer World *magazine, the largest selling micro monthly in Britain.*

He now runs his own information technology consultancy, is involved with interactive videodisc technology and is working on his fourth and fifth books. In what little free time he can find, he enjoys thundering around Spain on an out-sized BMW motorcycle, frightening the natives and searching for a lemon farm to which he can retire when and or if he makes his fortune.

Britain's first microcomputer show worthy of the name took place back in 1978, about the time I was becoming seriously involved in the industry. I remember standing at one booth watching an enthusiastic salesman show a puzzled prospect the very latest piece of gee-whiz hardware, a circuit board covered in chips with a rat's nest of wires connecting it to an uncased keyboard, a cassette deck, and a screen, which was displaying an impressive hex dump. "But how do I get it to print out my invoices," the punter asked in despair.

At a nearby booth, another smart-suited character was waving a cassette under a client's nose; they were standing in front of one of the first 8K Pets to arrive in Europe. " . . . and you can store details of up to 150,000 stock items on this one tape!" the salesman intoned.

Well, we have come a long way from those days! It took a long time, but the computer industry has finally recognised the importance of the "user interface." We had a brief spell when we all ran about proclaiming the necessity of computer literacy: everybody *must* learn about computers, we chanted. Then, of course, it dawned on us that if we were so bloody clever, why couldn't we make our computers *people literate* instead? Suddenly our micro world was infested with mice and adorned with more icons than Leningrad's Hermitage Museum.

Over here in Europe, we like to think that several thousand miles of ocean and continent give us a balanced persepctive on the latest micro-trends pouring forth from California. We haven't, for example, taken the IBM PC to our hearts at all—partly because it is expensive and partly because IBM delayed for 18 months before selling it over here, giving Victor and others the chance to make it with much nicer and cheaper computers.

The Victor 9000 (called the Sirius 1 here) still outsells the IBM, and IBM is reported to be very, very worried about the super new Apricot. Likewise, for price reasons, the Apple II was never a home/hobby machine here but was always a business computer—at first rather upmarket, now fading rapidly.

Going Overboard

When Lisa appeared, the world seemed to go bananas over mice. At least America did; we thought it was *one* answer, not *the* answer, and in fact I am increasing skeptical about mice. For instance, like most writers I know, I work in total desktop chaos. Besides my Sirius and two boxes of disks, I have great mountains of paper and assorted micro-junk covering every horizontal surface, with only a little free space left for a notepad and a coffee cup. There simply isn't room to swing a mouse.

Icons, while being quite nice to look at and probably fairly helpful to a raw beginner, can begin to grate after some experience on a system; I have a theory—as yet unproven—that the average executive might start to resent being treated like a child by the unspoken assumption, inherent in icons, that he can understand pictures but not words.

I don't want you to think I'm totally negative, however. I think mice and icons have a place, but it is a much smaller place than the current trend would have it. Personally, I think the touch screen—as on the HP 150—is a far better pointing and selecting device than the mouse. The operation is more natural—you look at the screen and

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STANDARD FEATURES	PRO	HAYES STACK	NOVATION SMARTCAT+	ANCHOR 1200	US ROBOTICS PASSWORD
300/1200 Baud (212A)	✓	✓	✓	✓	✓
Intelligent Microprocessor	✓	✓	✓	✓	✓
Tone and Pulse Dialing	✓	✓	✓	✓	✓
Hayes Command Compatible (Works with Smartcom™)	✓	✓	✓	✓	
Additional telephone jack with exclusion switching	✓				
Analog loop back self test	✓	✓	✓		
Self Test at Power Up	✓		✓		
Call Progress Detection (Busy, Dial Tones, Trunk Busy, etc.)	✓		✓		
Speaker and External Volume Control	✓	✓	✓		
Full Complement of Status Lights	✓	✓			
8 Switch Selectable power-up defaults	✓	✓			
Adaptive Dialing	✓		✓		
Auto Redial on Busy	✓		✓		
Ergonomically designed easy to read front display panel	✓				
Internal Stand-Alone Power Supply	✓				
Built in Real Time Clock/Calendar	✓				
Help Command	✓				
300 baud connect while maintaining 1200 baud RS-232 link	✓				
EXPANDABLE OPTIONS					
Automatic Receiver Buffer	✓				
Automatic Transmit Buffer	✓				
On-board Personal/Business Directory	✓				
Buffer, Expandable to 64K	✓				
Auto Logon Macros	✓				
Auto message transmission to groups of numbers	✓				
Records call duration	✓				
12-character Alphanumeric Display	✓				

*Comparison made by Prometheus on the basis of the best information available to Prometheus at time of printing

CIRCLE 195 ON READER SERVICE CARD

point, all in one movement, while the mouse requires you to look at the screen, then at the mouse, then back at the screen while you maneuver the rodent and finally to press a button or a key to tell the computer you have chosen.

In 1984 at least one very low cost—but powerful—business computer with speech recognition built in will hit the market. There is nothing new about speech recognition in itself, of course, and it still has a long way to go before it is perfect, but it is interesting that we are now at the point where this facility can be offered as standard.

"Human engineering" is now the single most important area of microcomputing, and we have a long way to go yet! Take, for instance, the operating systems we micro users currently have at our disposal. The market leaders—PC-DOS/MS-DOS and the CP/M family—all leave a lot to be desired, but then so do the challengers, the UCSD p-System and Unix and its spinoffs. They all share a common fault: they were designed by programmers. They are all easy to use if you are computer literate, but they are progressively more awful (in the order in which I have named them) for the uninitiated. We need something new . . . but what?

The Ideal

I suggest a combination of what we have now, taking the best points of each and refining them. Now that 16-bit micros are the rule rather than the exception, we have a lot more space for providing refinements; a major advantage of more CPU bits is, after all, the ability to address more memory.

Let's start with the heart of the p-System, because it is a good idea and we need as much in the way of portability as we can get now. Let's build it up a bit by incorporating Digital Research's GSX system, expanded to provide a fully portable terminal handler and software printer interface, because GSX is undoubtedly the way to go with the graphics interface problem. (MicroSoft's MSX standard is, in my opinion, silly; the last thing we need is hardware-dependent standardization.) And then let's wrap this up in a software interface that is as comprehensive as that of the Macintosh in terms of the number of facilities it gives the programmer.

What we now need is a common user interface, and here's where we enter more difficult ground. Personally, I like the simplicity of the CP/M and PC-DOS/MS-DOS approach when compared to the more complex systems, and I would like a more graphical refinement of the p-System interface, approaching that of the Macintosh/Lisa but accepting commands from whichever device the user happens to prefer—keyboard, speech, touch screen, mouse. I think much more research needs to be done into developing a man-machine dialogue which the uninformed can use without needing to look at a manual but which still allows the more experienced user to work fluently and efficiently.

As if all this wasn't enough, the system must be written so that manufacturers can install it with minimal effort (just a machine-dependent core). It must allow extra device drivers to be added easily by third-party software writers. It must be able to run existing CP/M, PC-DOS, and MS-DOS software unaltered, and it must be ROM-able—all of it.

Can this be done? Yes, I'm sure it can, and it probably will be done one day. A major obstacle is the tendency to believe that because we have developed one new interface—icons, mice, windows, whatever—this is *it* and we can go overboard about it to the extent of blinding ourselves to its disadvantages and to other possible solutions. The first person to overcome this and to adopt a broad user interface perspective will be the one to do it—and I'll bet he or she turns out to be a self-taught programmer.

If you were to write such an operating system today, you would have the devil's own job selling it because the opposition has gained too strong a hold. My final suggestion, therefore, is that we will *never* see such a "perfect," universally standardized operating system unless its author *gives it away!* And, crazy though it may sound, I have a sneaky feeling that this might just happen. ■

OF MICE, WINDOWS, ICONS, AND MEN/ HARVARD PENNINGTON

Harvard Pennington was born in California in 1937. After graduating from Bakersfield High School in 1955, Pennington attended Bakersfield College for less than a semester. He joined the Navy and was stationed in the Pacific on tankers and ammunition ships. Upon his discharge and he returned to Los Angeles and eventually joined Hanna-Barbera Productions, starting as a background painter and later becoming a department head. He worked on films and television productions, including the Flintstones, Johnny Quest, *and* Magilla Gorilla.

Pennington left Hanna-Barbera in 1970, became involved with radio-controlled airplanes, and eventually developed the Perry Pump, a carburetor for model airplanes. Pennington and a friend, Al Krug, started a company called the Internation Jewelry Guild (IJG). Pennington wrote a program for a TI 59 calculator to derive factors (including weights and prices) for diamonds. When the program outgrew the calculator, Krug and Pennington

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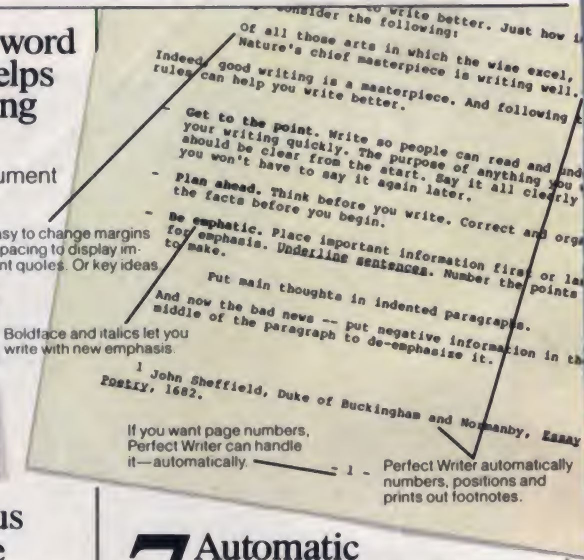

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purchased a TRS-80 in March 1978. By 1979, Pennington had written the book TRS-80 Disk and Other Mysteries, *which sold out two shipments before IJG received them from the printer. IJG closed down the jewelry business and concentrated on publishing computer books and software. Pennington became president of IJG in November 1981 and chairman of the board in 1984.*

The past is a blueprint for the future. In times past—the dark ages (about 1978, actually)—we were excited about floppy disk drives. Wow! 40 tracks! And double density controllers should be available before the end of the year. Why for a mere $1000 you could have almost 164K on a 5 1/4" disk. Within a few months, there was another craze followed by yet another, then another, and another. Then the hot stuff was mostly hardware. Today it is hardware and software.

Where will the future take us? The people who predict such things haven't done very well. They have mostly been wrong. Remember the bubble memory craze? What about the coming home computer market? They have been predicting it was just around the corner for the past years. It ain't here yet.

The Home Office

Then there are those who are predicting the work at home office. People will go to work by simply hooking up to the office computer. At 5:00 p.m. they will just log-off and call it a day. Fat chance. Can you imagine having to type everything you need to say? The average person can type only about 20 words a minute, and that's without counting mistakes. Can you imagine a three-way conversation through a computer keyboard and video link? What about a sales meeting?

Then, assuming that the office of tomorrow will be staffed by the current product, of the American school system, how are they going to communicate? Here is an actual example of a letter I recently received: I REASENTLY BROUGHT A COPY OF YOUR ELECTRIC PENCIL VERISON . . . I FIGUER IT MUST BE IN THE BOOT SECTOR SOME WERE, CAN YOU CHECK . . .

Before the dream can be fulfilled, we are going to have to do something about the educational system. The people who run the school systems tell us that the students are smarter and more sophisticated than their predecessors. They can prove it, too. With statistics. Hah! When they can prove it by interviewing them for jobs, I'll believe it.

What Else is New?

So, what is in our future? Windows? A mouse? Icons? Concurrent processing? Multi-user systems? And integration—don't forget integration. This is the hot stuff for 1984. How do we know it is the hot stuff? Because the computer press tells us, that's how. And how do they know? Because the marketing people tell them, that's how. How do the marketing people know? Because the finance people have determined that a market of a given size will net X dollars if they can come up with the next "hot" item, that's how. How does the financial community know that? Well, the truth is, they don't. However, no one is going to tell them to take their money elsewhere. In fact, if you can come up with an idea that is bizarre enough, you can probably raise a couple or three million dollars to bring it to market.

Icons

The best ideas (to raise enormous amounts of money) are those that propose to offset ignorance with technology—I call it *ignotech.* (I thought about calling it ignorology, but that sounded too much like the study of ignorance.) Icons are an idea based on ignotech. The use of icons supposes that you cannot read or comprehend words and therefore need a picture—icon. If you want a file from a disk, for example, there is an icon representing the file—a file folder or a file cabinet. With your mouse, you point at the icon and select files by pressing the mouse-button. (See, you don't even have to know how to type to use *this* computer.)

Icons and a mouse will not make a non-literate person literate. Pointing at pictures can last only so long. Sooner or later you must stop pointing and selecting, and begin to think and type.

Icons and a mouse will *not* make a non-literate person literate. Pointing at pictures (icons) can last only so long. Sooner or later you must stop pointing and selecting, and begin to think and type.

"Here, Zork, just point at what you want and then click the mouse button."

"UUUHHHhhhaaaaggg!" (Mouse: "click.")

"Oh, you want to write a letter. Ok, just sit here and type."

(Sounds of keyboard being demolished.) "Now, now, Zork, don't get frustrated. We're working on a new word processor that presents the entire English language in icons. It should be ready as soon as there are disks with giga-megabyte storage (next year's hot item)."

So much for icons.

Windows

The magazines are full of articles and ads about windows. I noticed one ad just today. Its headline screamed, "Our windows reflect the way you work." The picture accompanying the ad shows a screen with two window displays split about evenly across the middle of the screen and two smaller windows covering the two main displays in the background. The large background windows are impossible to read because of the two smaller windows over them. The two smaller windows are displaying less information than a $49 Timex display. I don't know about you, but I sure don't work with my reference material covered up.

Have you been around computers long enough to remember the "great screen width" controversy? (Would you believe that 80-column screens were once a "hot" item?) If not, I'll tell you about it. I got my first computer in March 1978. It was a Radio Shack TRS-80 Model I. It was a collection of grey boxes with 48K of user memory and a 64-column screen. It had some problems (enough to earn it the uncomplimentary nickname "Trash-80"), but it was a computer, and at the time,

the best there was. Apples were not readily available, and the other choices had to be built from kits or were very expensive compared to the TRS-80.

I was an immediate convert to computer life. I preached to all my friends, made everyone who came into the office sit at the keyboard, and spent hundreds (if not thousands) of hours convincing everyone with whom I came into contact that they needed one, too. However, the gurus of computing said that the TRS-80 was a "toyputer" because it didn't have an 80-column screen. "You need an 80-column screen for serious business applications," they said. The fact that we were getting our work done while they were contemplating the meaning of the mysterious BDOS ERROR ON A message on their Altos or Cromenco or whatever, didn't seem to faze them. As a matter of fact, I am still using those Model Is—all 19 of them. We don't even call them Trash-80s, anymore; "Cash-80" is much more appropriate.

This 80-column business went on until the advent of windows. Early last year (1983), we heard the first window announcements. Suddenly, it was fashionable to have displays of fewer than 80 colums. In fact, it become fashionable to have some of the windows cover up others. Eighty columns are out; 10, 20, 30, 40 columns (anything less than 80) are in.

Who is promoting this lunatic idea? Who is behind the window craze? Is it a communist plot? A devious government ploy to undermine our freedoms? Or is it the usual hype that we normally associate with things like Veg-A-Matics, Slim Whitman record offers, and the Popiel Pocket Fisherman? My choice is the latter. It is hype. Of course, the popular press, as well as the computer press, has picked up on it. To read some of these "news" articles, you would think the magazine authors and news reporters had spent the last 20 years working beside Grace Hopper developing some of this "great stuff." (I always get a kick out of reading their explanations of what bits and bytes are.)

Overlapping windows require a lot of memory and processor time. Because of their very nature, they are a "graphics" presentation which requires graphics memory for the video screen, as opposed to normal video memory for text.

Does this mean that I am opposed to windows? Not on your life. I like the split screen variety. They are quite useful from time to time. On occasion, I even split my *Electric Pencil PC, VisiCalc,* and *MultiPlan* displays.

So, what is all this whining and bitching about overlapping windows, the mouse and icons? What is their future? They are here to stay. They will be promoted as "features," on countless products. That does not mean that they will be used. (How many people actually use a Veg-A-Matic?)

The real future is in smarter software—not ignoware for ignotechies. It is in more versatile hardware. Cheaper hardware. Faster hardware and more efficient languages (the language of the future has not been invented yet). The future is also "on the shelf." It is right before our eyes. All we have to do is use what we have to make a better (if you'll pardon the expression) mouse trap. ■

THE GREAT UNFULFILLED PROMISE/RODNAY ZAKS

Born and educated in Paris, France, Rodnay Zaks obtained his baccalaureat in 1962. At 21, Zaks transferred to the University of California, Berkeley, from which he obtained his doctorate in computer science, only the third person to have been awarded this degree from Berkeley, in 1972. While at UCB, Zaks worked on Project Genie, one of the earliest and most successful time-sharing computer systems to be developed. He also led a project for the development of a very high speed microprogrammed APL interpreter on a state-of-the-art computer, acquiring experience in advanced hardware and software design.

In 1976, Zaks, who had lectured widely on microprocessor designs and applications, founded Sybex to conduct training sessions for technical audiences on the use and design of microprocessors and microcomputers. With Zak's first book, Microprocessors, *Sybex entered book publishing; it was an immediate best-seller—all 5000 copies sold out within weeks. With the success of the book, Zaks began shifting the emphasis of Sybex from seminars to publishing. Since then, Zaks has written 17 books on all aspects of microcomputers. His books and those of Sybex's 15 other authors have been translated into 14 languages.*

Ever since computers were introduced, the great promise has been that computers are easy to use, that anyone can use them easily. This is not true. This promise cannot, and will not, be fulfilled. Anyone using a computer or contemplating its purchase should understand this. Computers have benefits and limitations. I will explain what to expect, what not to expect, and what you can do about it.

First, I will look at the difficulties involved in accessing a program, then operating it. Then we will examine what will and will not happen in the future. We will distinguish two key issues now confused by manufacturers: the ease in using the computer proper and the ease in using the application programs. We will draw the important distinction between two types of application programs (active and reactive) and show why most application programs will never be "easy to use" without one key ingredient: skill.

Finally, we will examine what you can do to use computers effectively today or in the future and how to be successful at it. Let's now examine what's involved in accessing a program.


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Getting to Use a Program

As a designer of early computer systems (I designed and published one of the first industrial microprocessor-based computer systems in 1972) and as a user of most small personal computers since, I have witnessed the painfully slow improvement of convenience features on personal computers and programs until this day. Let's take a look at what's needed to activate a program:

• Set up the equipment. Connecting a printer or a modem just a few years ago still involved skills, efforts, and hope. This is today no more than a chore. Just plug the components together. This problem has been solved. It's easy.

• Operate the equipment. On early microcomputers, you had to press many keys and switches in a complex sequence just to do the simplest things: skills and patience were required. Today, one or a few simple commands, the movement of a mouse, or even the touch of a finger on the screen will cause operations to be performed. It's easy. Operating a computer no longer requires skills. The obvious chores have been overcome except maybe for the fact that most people would rather talk to the computer than press keys. This will be possible in the future. This problem has also been solved.

• Access the program. The reason you turn a computer on is that you want it to perform some useful action for you, such as word processing, accounting, or playing a game. In the past, a complex sequence of instructions had to be given. This chore has now been eliminated. Today, accessing a program may be as easy as plugging in a game cartridge or moving a mouse to designate the program you want to activate. The operating system of the computer takes care of the details and performs the tasks required. This problem has also been solved. It's easy. What's left?

• Use the program. In the current state of the technology, the user must type or point to commands on the screen and learn or memorize them to cause the desired action. Using the program involves a combination of chores and skills, depending on the sophistication of the program and what it does. It's not easy, and we shall see that, in many cases, it never will be. There remains the key difficulty that we will examine.

The reason you turn a computer on is that you want it to perform some useful action for you, such as word processing, accounting, or playing a game.

Using a Program

Steps one, two, and three above normally involve no more than minor chores such as plugging in cables, connecting peripherals, and performing a few simple actions to cause the computer to activate the desired program. This aspect of computer usage was easy to automate and has now been automated successfully: it's easy.

We can compare this progress to the evolution of the automobile: At the beginning of the century, using a car involved a complex sequence that required chores, skills, as well as a lot of patience and, of course, luck. The engine had to be cranked up. If the weather was cold, it even had to be warmed up. The mixture of gas and air had to be adjusted, and many buttons and levers had to be pushed, pressed, turned or squeezed for the engine to start—maybe. With the progress of mechanical and electronic engineering, modern cars can be started by merely turning a key. All other chores have been eliminated so that the driver can now concentrate on getting where he wants to go. With computers, the situation is quite similar. Computers today are easy to turn on, and the desired program is easily activated, so that the user can now access the program in one or two steps. The only remaining problem is to get the program to do what the user wants it to do.

Operating a car has become more convenient, more comfortable, and perhaps safer today, but driving still requires basic skills that are still much like those that were required at the beginning of the century.

Similarly, operating a car has become more convenient, more comfortable, and perhaps safer today, but driving still requires *basic skills* that are still much like those that were required at the beginning of the century. Again, we will see that there is a significant analogy in the use of computers today: skills are required to "drive" them—as opposed to starting them.

Active and Reactive Programs

An *active* program is one that allows you to give it a sequence of instructions. An active program generally acts on data *you* supply. For example, a word processing program is an active program, as is a spreadsheet program or even a programming language such as Basic. You issue instructions to the program that cause it to execute sequences of actions on your data until the desired final result is obtained.

An active program usually has little or no built-in data, and typically, you enter or create the data yourself, then manipulate it by giving commands to the program. For example, you type a letter (the data) then edit the letter with a word processor (a sequence of commands), or you type tables of numbers (the data) and then modify those tables using a spreadsheet program (a sequence of commands). To use an active program, you must learn its commands.

A *reactive* program is one that merely informs you selectively after asking you specific questions. Examples are educational programs that teach you math, typing, and other topics and, depending on your answers, modify their reactions accordingly. These programs are generally equipped with *built-in* databases that contain the information which will be presented to you. They present pieces of this information selectively to you, depending on questions and answers, i.e., the

dialogue between the program and yourself. For example, an automated phone directory is a reactive program.

In summary, the essential difference between these two types of programs is that the instructions of an active program are changed or created by *you*, whereas the instructions of a reactive program are *unchangeable*. An active program is like a programming language: you specify a sequence of instructions to do something useful. On the other hand, a reactive program requires no specific program knowledge on your part and will guide you along a path to the information it contains.

Obviously, reactive programs can, and should be, extremely simple to *use* (as opposed to *design*). Virtually anyone should be capable of using them. There is nothing you have to know in advance about the program itself, although you may have to know about the topic, i.e., the database. If there are

Designing better programs is a long and costly process.

any remaining difficulties involved in the dialogue with the program, it is the fault of the software designer, and the chores or inadequacies can and should be removed in the *future*.

However, in the case of an active program, things are quite different: the user must master a new programming language, i.e., how to use the set of commands required to operate this active program. This is a skill that must be acquired. The software designer can make communication with the program easier or more fun but he cannot supply the skills required to use the program itself. The more sophisticated the program, the more resources it offers, the more skills may be required of the user. *Active programs require skills.* They are not easy to use without them.

Skills

Skills are the key to understanding why computers will not be easier to use in the future. Most useful application programs available today are active programs. They require skills. This requirement will not go away. All the other aspects of using computers and programs will be improved, polished, and made more pleasant, but skills will still be required to operate active programs. The very purpose of providing a good active program is to bring you an advanced "programming language" (the application program) that can perform and automate complex tasks or procedures for you. Unless you acquire the specific skills required, you will be limited to using either reactive or simplistic programs.

What is Needed

The burden placed on the computer manufacturers is quite simple: to sell computers, they must make them easy to use, i.e,. alleviate or remove the remaining chores involved in accessing a program on a computer. Indeed they do. We are now buying convenient computers, with high-resolution screens, the convenience of pointing to the screen with a mouse or by touching the screen and the convenience of activating commands or functions by pointing to a symbol (called an icon) rather than having to type or move a cursor.

The remaining problem is making programs easier to use. This means two things: improved convenience in using the programs themselves and programs designed to require fewer skills or designed to teach them.

Unfortunately, designing a good active application program is analogous to designing a good programming language: it is a difficult art. In time, well-designed sophisticated programs will be introduced. An old programming saying is: "the simpler the program appears to be, the longer it took to design." Hardware and operating system standardization is required to make it worthwhile for software developers to invest time, effort, and money in designing such sophisticated programs. Designing better programs is a long and costly process. It requires a large number of computers sold and a sufficient permanence of the standards to make it worthwhile to carry out the development.

Developing a good reactive program is equally complex and even more risky since most reactive programs incorporate a fixed behavior pattern and a fixed information base and, therefore, have a high risk of mortality. If there is any change in the database or in the behavior, then the program must be redesigned—a major endeavor. This risk is acceptable for simpler programs as long as they have a very wide distribution (games, for example) but the risk is high for sophisticated home and professional applications. This is why the bulk of the programs currently available are active programs and are likely to remain so for the short-term future.

In summary, except for simple games and educational programs, if you want to use a sophisticated application program, say for business, you must acquire specific skills.

If you are willing and able to acquire those skills, you will be able to derive the full benefit of computers in years to come. This need for skills won't disappear. Manufacturers are generally afraid to tell you that useful programs are not easy to operate unless you learn new skills, and they have done their best to cover up that fact.

What to Do

Sophisticated users understand that additional effort will be required to use a program. This is when a last-ditch marketing claim is made by the manufactures: "all you need is a (thin) manual." If you already have the skills—for example, if you already know how to use a word processor—then, indeed, all you may need is a manual. Just as if you know two or three programming languages, all you may need to use a new one is a manual. However, for the vast majority of users, this claim is simply not true. You need more than a manual; you need skills. What should you do?

A manual presents *information* about the commands and what they do. It doesn't teach you how to use them. To acquire those skills, you need to be shown how to operate the program through direct help, courses, or books. You need *training*.

Many of the obstacles involved in using computers and programs today are on the way to being removed.

People acquire skills in many ways. Many of us like to be shown how to do something. If you have access to a tutor or courses near to you, this may be the best solution. If you do not, then reading a suitable book or publication (one intended to teach skills) is usually the best way. This is what my company and I have concentrated on and why I feel the need to speak out on this im-

portant issue. Understanding this point is vital to the useful opeartion of a computer today and in the future.

Conclusion

Many of the obstacles involved in using computers and programs today are on the way to being removed. It has now become easy to turn a computer on, access a specific program, and issue commands to it. In the future, improvements will be made in the way we communicate with application programs. At the same time, application programs will become much more complex and sophisticated, allowing you to automate tasks or perform actions that you would not have considered possible before.

Application programs will become much more complex and sophisticated, allowing you to automate tasks or perform actions that you would not have considered possible before.

To do that well, in most cases, you will still require one essential ingredient: skill. For each new type of active program that will be introduced, you will need to learn how to use it effectively. And this is the very power and magic of computers. Computers together with the programs installed on them are nothing but an extension of the human mind that allows you to either control the machine (using an active program), or be controlled by it (a reactive program), leading to almost infinite complexity.

You will, no doubt, want to acquire skills in an area which is useful or pleasant to you. In the process of acquiring skills, you will face the same difficulty all of us do: there are few good educators and fewer good educational aids. A very few publishers have been dedicated to providing the very best educational tools that can be provided in the form of books, and we hope they will allow you to derive the full power and benefit of what computers—as well as yourself—are capable of. I wish you a pleasant journey on your path to knowledge. ■

REASONS FOR NOT LIKING EASY-TO-USE SOFTWARE

Ted Nelson

I. THE OLD WAS GOOD ENOUGH

I learned it, why can't you?
What's complicated about it?
I had no problem learning
All you have to do is just look in the manual.
That easy stuff is for kids
This sort of thing is all right in its place, but not for computer professionals.

II. THE OLD WAS BETTER

It's discipline that's good for you.
It's really elegant/logical, if you just take the time to study it.
They've taken away the logical beauty and covered it with mud.
Computers were not meant to be used so fast.
Such things were not meant to be.
What's the matter with these people?
The next generation won't know what it means to type a command line.
If someone wants to sit here acting like a damn fool, that's all right, but count me out.
I say it's stupid.
It's all sizzle. Where's the beef?
Six months from now it'll be some other fad.

III. THE NEW IS BAD

We're losing sight of basics.
This is just a symptom of what's wrong with the world today.
They keep wanting "more features," never less.
Kids shouldn't see this stuff-- they'll get a false sense of reasonableness.
Where will it end?

IV. WHAT'S TO NOT LIKE

I don't like the mice.
Look at all you have to go through to do a simple [...]
I want to be able to do it with one keystroke.
Yeah, this sort of thing is fine, but look who has to maintain it.
If people are too stupid to use computers *right*, they don't deserve to.
I have better things to do than coddle morons.

V. TO HELL IN A HANDBASKET

Maybe some people just shouldn't use a computer.
Things shouldn't be made easy -- it destroys character.
If it becomes this easy, use of computers
will pass out of the hands of those who really understand them.
It will cause unemployment.
It will cause widespread social disruption.
If you make things too easy, they'll be overused.
It will strain the people.
Everybody will want one.
Mice will give people misshapen arms.
Our fingers will atrophy from not using the keyboard.
They want to reduce people to a lump of jelly.
If God had intended computers to be used that way,
He would've given us light pens instead of fingers.
A man is a man and a computer is a computer,
and if we let them get this close together,
the next thing you know...

BASIC IS BACK/ THOMAS KURTZ

Thomas E. Kurtz, professor of mathematics and computer science at Dartmouth College, received his B.A. from Knox College in 1950 and his doctorate in mathematics (statistics) from Princeton University in 1956. He became director of computing in 1959 and director of the Kiewit Computation Center at Dartmouth in 1966, leaving that post to return to teaching in 1975.

He and John G. Kemeny have collaborated on many computer projects, including the design and development of the Dartmouth Time Sharing system and the programming language Basic. Recently, they joined several others to form True Basic, Inc., whose goal it is to produce a high quality personal computer implementation for educational use. From 1974 to 1984 Kurtz served as chairman of the ANSI committee X3J2 that is concerned with developing a national standard for Basic. He has written articles on instructional computing, and published a text on statistics, Basic Statistics, *and (with Kemeny), a text on programming,* Basic Programming, *now in its third edition.*

What is the truth about Basic? Does it merit mention in the same breath as Logo or Pascal? Is it even a language? Should it be taught in schools, or should it be exiled forever? Depends on whom you talk to. Since in this short article it is my turn, let me try to convince you that Basic, the language used by more people around the world than any other, is growing up and, like the prodigal son, returning home to its rightful place of honor.

John Kemeny and I, assisted by a small group of undergraduates, invented Basic more than 20 years ago. We have seen it grow and prosper as a teaching and applications language at our institution, where it is accorded great respect. But in the outside world, things are different; while Basic is the lingua franca among the hobbyists and kids, it is an object of scorn among the computer intelligentsia.

It is not hard to dissect this apparent schizophrenia—we are talking about completely different versions of the language. What we used 20 years ago lives on as Street Basic: no lower case, only GOTO and IF-THEN statements to augment the simple FOR-NEXT loop, GOSUB statements that referred to subroutines by line numbers and allowed no parameters. Small wonder that computer scientists gag at the thought, especially in view of the new understandings about structured programming. In fact, I even heard one well known computer scientist publicly declare, "I hate Basic!"

The disorderly world of Street Basic is a far cry from the more orderly world Dartmouth fashioned for itself over the same 20 years. We kept the language clean but still adapted to what we needed in programming languages. By 1971 we had callable external subprograms with parameters, which could be collected into libraries and separately compiled. By 1971 we also had interactive graphics, mainly throught the efforts of our colleague, Arthur Luehrmann.

By 1976, we had structured constructs, largely through the efforts of another colleague, Stephen J. Garland, who called this variant of Basic "SBasic," for Structured Basic. In 1979 we added true multicharacter variable names, internal and external subroutines and functions. The 1979 version even introduced what Professor Garland called "groups," a packaging structure (like the ADA "package") aimed at allowing true "data hiding" in Basic.

When we switched to SBasic in 1976 for several of our courses, we noticed that our students could handle programs about twice as long as they could before. We performed no statistically controlled experiments, but we could see with our own eyes that structured programming (using better loop and choice constructs while reducing or eliminating GOTOs) brought immediate improvement. We could even, and often did, write programs without line numbers; if there are no GOTO or similar statements,line numbers are not needed.

This present version of Basic is so rich and clean that Pascal, Fortran, and other famous languages, are just not widely used on our campus. Basic is quick and easy for small programs, and yet easily scales up for large applications. And it is used for the introductory computer science course.

A New Standard

Except for one particular development, what I have just outlined would not be partiularly relevant. (After all, software developments at isolated colleges and universities rarely have major effects outside their walls.) That development is the pending ANSI Standard for Basic, now in the final stages of approval and, we hope, acceptance. The features described above are almost exactly those found in the new (proposed) Standard, because we have made the effort to pattern our Basic on the Standard.

> *Basic is quick and easy for small programs, and yet easily scales up for large applications.*

ANSI Basic contains (or more properly, will contain) a good collection of structured constructs, along with many other features one expects to find in a language standard: internal and external functions and subroutines, a large graphics module (optional), an elaborate file system including both display-format and internal-format files, fixed-decimal (optional, for those who want it), a matrix package, and line-numbered GOTOs and IF-THENS (coming in under the grandfather clause).

Perhaps the harshest criticism of the ANSI Standard is that it is too large, contains too many special capabilities, and looks like it was designed by a committee (which it was). We accept this criticism, but the state of affairs that caused it was inevitabie. Basic boasts many constituencies around the world, each having a different idea as to what should be in the language. It is difficult, if not impossible, to produce the nice simple clean language that will satisfy each constituency.

That is the bad news. The good news is that there is enough in the language to allow folks to select what they want to use or teach. We use Basic in our introductory computer science course, ignoring GOTOs and other control statements that use line numbers. We stress modularization using both internal and external procedures (defined functions subroutines). We talk about parameter-passing mechanisms and scope of variables names. We use groups (which are not in the Standard) to allow variables to be shared among several subroutines but not with the entire program.

Many people find the complexities of a language like Pascal too much to face at their first exposure to computing.

Basic as a Bridge

At the other end of the pedagogical spectrum, if a third grade teacher wants to start out with simple programs using GOTO statements, that's okay. A month or a year later, that teacher can introduce the constructs of structured programming and tell the students that GOTO statements are no longer needed. Incidentally, we do not think that starting with GOTOs and then swithing to structured programming is a bad strategy, as claimed by some.

In fact, we have gathered some anecdotal evidence that many people find the complexities of a language like Pascal too much to face at their first exposure to computing; once introduced to computing through Basic, these people readily make the transition to Pascal, if that is the goal. (Basic was invented partly because we felt that the begin-end construct and the need for semicolons rendered Algol unpalatable to liberal arts students.)

The teacher can, as we often do, introduce the idea of modularization through internal subroutines without parameters. Once that notion is comfortable, parameters can be added. The subroutines can then be "detached" (made external). Several of them can be collected into libraries. And these subroutines can call themselves recursively.

Our conclusion is that the new Basic can readily fill the gap between Logo, in the lower grades, and Pascal, in the senior high schools and in the colleges. Basic also provides a nice alternative to Pascal for those who don't need data structures but who otherwise want to write large, well structured programs. We certainly hope that Basic will enjoy a comeback into respectability, but only if it is the New Basic. ■

MISCONCEPTIONS ABOUT LOGO/SEYMOUR PAPERT

Seymour Papert studied mathematics and philosophy at the University of Witwatersrand in South Africa, at Cambridge University in England, and in Paris, France. He has two doctorates in mathematics—from the University of Witwatersrand and from Cambridge University. Having met Jean Piaget in Paris in 1958, Papert worked with Piaget for the next five years at the University of Geneva, then came to M.I.T. in 1964, where he and Marvin Minsky co-founded the Artificial Intelligence Laboratory in 1967.

The research he conducted there led to the development of Logo, and he became director of the Logo Group in 1970. Logo and the philosophy behind it are described in his book, Mindstorms: Children, Computers and Powerful Ideas, *published in 1980. Papert's current teaching and research activities focus on the area in which technology, education, and human sciences intersect.*

People often congratulate me for making such a good language for children. But they are wrong. Logo isn't a "good language for children"—in fact, a language that was "good for children" in this limited sense would *not* be good for children. Children deserve a language that is good, period. Logo is only good for children insofar as it is good for everyone.

Something similar can be said in response to other remarks one hears about Logo. They say it is a good language for graphics. But this is also looking at things the wrong way around. A language that was "good for graphics" and nothing else would not be a good language for graphics. To do graphics well, you need a powerful, general purpose language.

Why is something that is intended to be "good for children" not really good for children? Some obvious examples are all the simplifications and perversions of Logo, the so-called "Instant Logo" that springs to mind. Some of the commercial products are also simplified versions of the sorts of things children usually do in their first few days, perhaps even weeks, of Logo.

The reasoning behind these Instant versions is that for a young child who does not yet know the alphabet and the keyboard, typing the command FD 10 is too time-consumig and frustrating. So these six keystrokes (including the space and carriage return) are reduced to one: F. But this robs the child of the opportunity to think about the experiment with numbers that is implicit in Logo. This

restriction becomes even more significant in exploring angles. How can one discover what a 45-degree angle looks like when he can turn the turtle only in multiples of 10 or 30 degrees with each keystroke? Or that LEFT 90 and RIGHT 270 produce the same result?

Far more important, Instant versions of Logo don't provide the experience of gaining an increasingly rich understanding of the same intellectual entity. An exciting educational aspect of Logo is that a five-year-old can do something interesting with it, and a graduate student can do something else interesting with it. The fact that each is using the same language, exploring the same system, means that both have the opportunity to gain a richer and deeper understanding over a long period of time—albeit at different levels—of materials that are essentially continuous.

This brings us to another misconception. Logo is said to be an "easy" language—but it is not. It *is* designed to have easy routes into the language. Using commands like FORWARD 20 and RIGHT 90, one can do quite interesting work at this level of comprehension—where Logo statements sound like English and can be understood in this spirit. But there comes a time when more subtle kinds of understanding are necessary. No child (nor any adult who is not sophisticated about formal systems) get there without long experience or good instruction, because these more subtle ideas really are difficult. Logo would have no point if it were nothing but an easy language. It has a point because it starts off easy and then becomes difficult gradually enough that no one need ever drop out.

In this respect, Logo is much like a natural language such as English. Baby talk allows the child an easy way to grab onto and use pieces of the language. But nowhere in the world is a language restricted to baby talk. The child continues to be immersed in the full richness of language as used by philosophers and poets. It is the quality—the rich complexity that opens up as one explores Logo ever more deeply—that makes Logo "good for children" and for adults as well. ■

STAND-UP COMPUTER PROGRAMMING/ BILL BUDGE

Bill Budge has been programming since high school. He received a B.S. in computer science from U.C. Berkeley and was working on his doctorate in that field when he discovered personal computers. He then set aside work on his doctorate and started writing computer games including the best sellers, Raster Blaster *and* Pinball Construction Set. *He is now working on his first Macintosh program.*

The trouble with computers today is that they are for "squares." To make a computer do something exciting, you have to put in hours of painstaking work at a keyboard. Computer programmers are not rock stars. Crowds don't gather to watch them type, because during most of the time that they are working nothing interesting seems to be happening. Instead of jamming, programmers spend much of their time concentrating on tiny details. And for good reason, for in their world, the slightest offense can have disastrous consequences.

This drudgery makes programming look a lot like accounting. In fact, programmers and accountants are very similar: they are people who enjoy the systematic analysis of puzzles and problems. Typically they are careful, logical, thorough, conscientious, and deliberate—in a word, square. To some people this is a turn-off.

> *Programmers and accountants are very similar: they are people who enjoy the systematic analysis of puzzles and problems.*

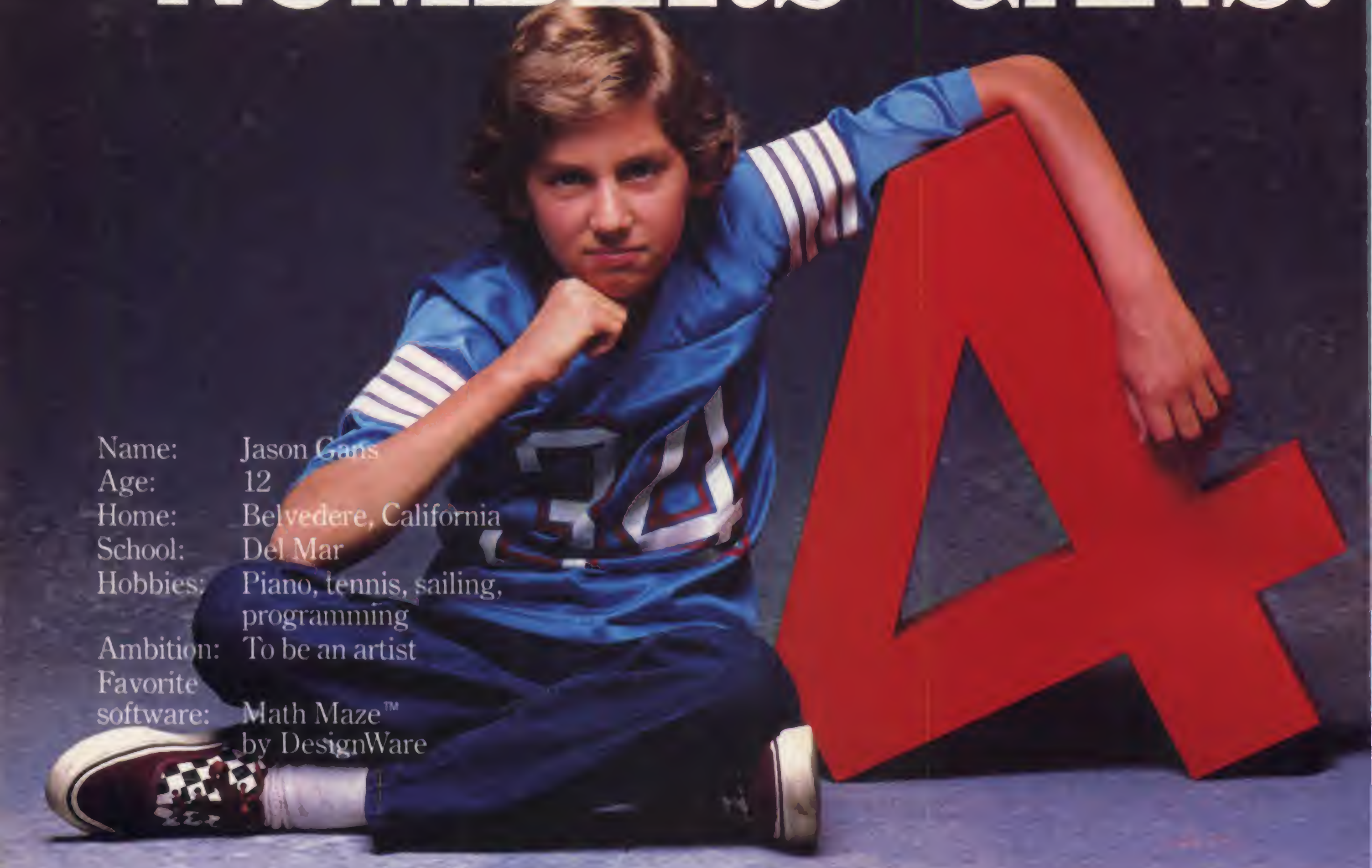
There is nothing wrong with squareness. Everyone has some tendencies to squareness (it is highly desirable in your doctor or auto mechanic, as well as your accountant), but most people have another side as well, one that is emotional and intuitive. Real people trust their feelings. They wing it. They break a few rules and recover from their mistakes. They play fast and loose, get in the groove, and have some fun. Just as there is a time and place for square values, there are situations in which the groovy side can be powerful and effective.

The problem is that computing is hardly ever groovy. Squares build the hardware and the software, which tends to reflect their square values and to entrench them further. This creates a barrier for groovy types; if they wish to use this new tool, they must embrace an alien ethic. To one who grooves, a journey through the square world of rules and logic is frustrating, boring, a drag.

One of the most exciting things about the personal computer, indeed what really makes it a revolution, is that large numbers of groovy types have crossed over into the square world, at least for a while, in order to make new tools and toys for themselves. They are artists, and they have suffered in the square world, but their work is breaking down the barriers to computing for the masses.

The first programs to reach into the groovy dimension were sketchpads,

THEY CALL HIM "NUMBERS" GANS.



Name: Jason Gans
Age: 12
Home: Belvedere, California
School: Del Mar
Hobbies: Piano, tennis, sailing, programming
Ambition: To be an artist
Favorite software: Math Maze™ by DesignWare

"*Math Maze* is neat because you do more than just add and subtract numbers all the time. You've got to find them first. And then get there before you get caught.

"It's got real good graphics. I can even change the background color. And make the math as challenging as I want.

"There's lots of mazes, too. But the best thing is, I can make up my own. So when my friends come over, I've always got something new."

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As Jason Gans says, "Hey—they don't call me 'Numbers' for nothing, you know!"

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music synthesizers, and video games. With these programs it is possible to groove at the computer, to become connected with it. Millions of people with no computer experience have become involved with video games, because to be good at Defender or Pac-Man is to understand the essence of grooving. And while squares can't understand what people would use MacPaint for, everyone else picks it up and immediately begins to churn out pictures, announcements, maps, and even works of art.

This is what the personal computer revolution is all about. The repercussions are being felt even in that bastion of squareness, the world of mainframes and data processing, where users are suddenly asking why their programs can't be as fun and easy to use as the ones on PCs.

But people who can straddle the gap between the square and the groovy are rare, and there aren't enough great pieces of software yet. What is really needed is to inject programming into the groovy dimension, to provide the tools that let everyone exploit the power of a computer. The computer is the best toy ever, and people should be able to play with it with no constraints.

This is a terribly hard problem, because programming was invented by

> *Millions of people with no computer experience have become involved with video games, because to be good at Defender or Pac-Man is to understand the essence of grooving.*

squares for squares. The groovy side has nothing explicit to say about it because in the groovy world there is nothing quite like a program. But the groovy world does contain a great wealth of useful concepts and ideas with which everyone is familiar. Could this wisdom be tapped to create metaphors for programming?

One metaphor has been suggested which is particularly apt and can be stretched very far. It is that programming is theater. Perhaps someday there will be a program that allows people to choreograph video games, script their own adventures, and create and employ software actors as their agents. It is quite clear, however, that most people will never become skilled at using any existing programming language, not even Basic or Forth or Smalltalk. This is something the squares don't understand.

Unfortunately the language of the computer medium hasn't been invented yet. It remains a dream. It will be invented, though, and we will get to see it, just as people early in this century witnessed the birth of the language of movies. The home computer is still largely a curiosity just as movies were once a nickelodeon novelty.

It is waiting for its D. W. Griffiths, its Charlie Chaplins. It will have them. Because its strength is its interactivity, it will be a medium of play. It will be a medium of grooving, too, both for its artists and its audience of users. And who knows, someday we may even find ourselves applauding a stand up computer programmer, the Robin Williams of software. ■

GIVING THE ARTISTS THEIR DUE/JIM LEVY

We at Activision are delighted to participate in this 10th anniversary celebration by *Creative Computing,* one of the pioneers in the field of personal computing journalism and one of the early sources of my education on the personal computing business.

Activision was also a pioneer. At the time we were founded, the independent computer software industry consisted mostly of very small creative units which seemed to operate mostly from bedrooms and garages. The lion's share of software available in 1979 was produced or distributed by the leading hardware manufacturers. Activision was the pioneer attempt by an independent software producer to go head to head with the majors.

We also pioneered a concept of original product and artist development about which much has been written, discussed, and debated over the last few years. Yet, despite Activision's success and the widespread acceptance of the concept among many of our competitors, there is still a lot of question today about how it works and whether "the artist can be trusted" to produce work that finds widespread market acceptance.

Imitation vs. Imagination

Much of the work in home computer entertainment and video game software over the last five years has been drawn directly from sources outside the industry—video game arcades, movies, books, board games. When Activision began, most companies felt that success was dependent on the acquisition of one or more of the relatively few successful arcade licenses that became available each year, because such licenses seemed to promise automatic hits. This process expanded to movie themes, books, television series, and the like.

Activision, on the other hand, believed that the key to success in the software industry was the development of talent, not the acquisition of rights. We believed then and now that, while the acquisition of an arcade title may provide for some near-term sales success, the development of talent is the strategy which is critical not only to a software organization's ability to compete over the long term but to the very development of the industry. We believed that the industry eventually would be almost totally dependent on original talent working to create new and exciting entertainment software for millions of home computer owners.

This philosophy of artist development and recognition was directly opposed to the way the major software entities were creating software in 1979, but was obvious to those of us who founded Activision. Three of us were creative people who were looking for artistic freedom and market recognition. I had spent a number of years in both the publishing and recorded music industries where the strategic importance of artist development and recognition in those industries is a foregone conclusion. It never really occurred to us to do it any other way.

Our philosophy of artist development and creative recognition has been instrumental to Activision's success.

We have been able to expand our talent roster and provide new creative and market opportunities to many software designers over the last few years.

Creativity Joins Technology

The future of our industry rests as much on its creative strength and diversity as it does on technological developments. It was the extraordinary explosion of software in the 1980-82 period that drove the rapid growth of video games. Now we have a new generation of hardware with which to work—home computers like the Commodore 64, the Atari computers, the PCjr. Each is capable of doing great things, but is totally dependent—at least for most users—on the quality of software available in the marketplace.

Without continuing growth in and diversity of creative talent in the software industry, both the software and hardware industries will continue to suffer the kinds of difficulties we have experienced during the last year.

Not all of the problems that our industry has faced since early 1983

Our major challenge in the industry in the years to come is to continue to discover and develop new creative talent—the software leaders of the next half of the decade.

were founded in software creativity. Nevertheless, a cursory review of much of the software released in the industry in the second half of 1983 shows a certain stagnation in creative style, concept, and content. We had begun to repeat ourselves. And, the consumer could see it. Even at the January 1984 Consumer Electronics Show in Las Vegas, there were very few exciting, new creative ideas. Much of what we saw was either a re-hash or a copy of earlier concepts updated with a few new bells and whistles.

Our major challenge in the industry in the years to come is to continue to discover and develop new creative talent—the software leaders of the next half of the decade. This does not mean that we cast aside the creative geniuses who helped build the industry over the last five years. Most of them still have a great deal of energy to bring to the development of new ideas.

However, if our industry is to continue to grow, it must continue to expand in the breadth and depth of creative product we offer to the consumer. This can happen only if we are continually developing new talent. Whether the talent works individually or in teams, as stars or as behind the scenes contributors, it is creative leadership and diversity that will determine whether the home computer software industry will achieve its true potential for greatness by the end of this decade. ■

PIRACY AND SOFTWARE PROTECTION/ MITCHELL KAPOR

The idea of an integrated package—combining spreadsheet, graphing, and information management—first occurred to Mitchell Kapor in 1981. Kapor, who had designed VisiPlot *and* VisiTrend, *brought his graphing and program design experience to Jonathan Sachs, who has three spreadsheet designs to his credit. With a database added, their conception became reality—the* 1-2-3 *integrated software program, currently the best-selling business applications program for personal computers.*

Kapor founded Lotus in April 1982, introduced 1-2-3 *in October, and shipped the first product in January 1983. The company, profitable in its first month of operations, went public less than a year after the introduction of* 1-2-3 *and reported sales of more than $50 million and net income of more than $14 million in 1983, its first full year of operation. Kapor has a B.A. in psychology from Yale University and studied at MIT's Sloan School of Management. Drawing on his long-term interest in mathematics and computer science developed as an honors student in high school, Kapor taught himself computer programming.*

Software piracy—the illegal duplication of disks and documentation—is clearly a major problem for the software industry. While existing copyright and trade secret laws are generally regarded as adequate, but not optimal, the general lack of seriousness with which they are taken by end users has created an ugly problem and one which, to date, had defied solution.

Too many discussions of software piracy have had the stale flavor of cracker-barrel commentaries on the weather—all complaints, no control. Worse still, solutions proposed by software industry participants overemphasized technical approaches to the exclusion of educational and other approaches. Such efforts, while clearly well-intentioned, are fundamentally misdirected and serve neither the industry nor end users well.

Shoplifting and Piracy

In many ways, software piracy is like shoplifiting. A prudent retailer seeks to control shoplifting, while understanding that seeking to eliminate it entirely is not only unrealistic but contrary to his self-interest. In maintaining an acceptable upper bond on "inventory shrinkage" (a polite term for theft), certain technical measures such as closed-circuit cameras

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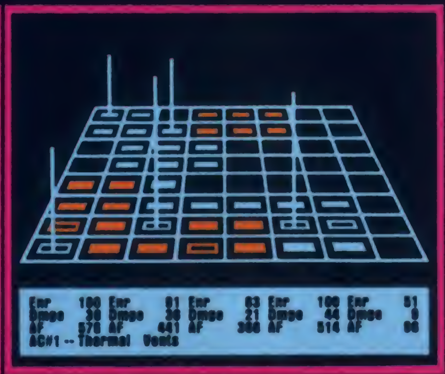

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and electronic detection systems can be employed as deterrents. These keep honest buyers honest by reducing the opportunities for successful, casual theft. At the same time, an educational system and a culture which view theft as immoral, the existance of strong laws prohibiting it, prominently posted warning signs, and an advertised willingness to prosecute shoplifters serve to control those who will attempt to steal anyway. The problem of shoplifting is addressed by a mix of methods—some technical, other legislative and enforcement-oriented—coupled with communications which increase awareness of the issue.

Suppose all shoppers were forced to be strip-searched whenever they entered or left a store. Doing that would radically decrease theft, but in a totally unacceptable way. First, the actual dollar cost of such enforcement would be

Users have a fundamental right not to be burdened by technical protection.

prohibitively high, thereby decreasing profitability.

Second, as anyone familiar with prisons knows, even the most stringent security can not completely eliminate the flow of contraband. Finally, and most importantly, such measures would rightfully be regarded as absolutely unacceptable infringements on the rights of consumers in a free society. In summary, there is a point beyond which theft control measures are too expensive, unworkable, and clearly inappropriate.

The parallels between shoplifting and software piracy should be obvious. The realistic goal of software providers ought to be the control, not elimination, of piracy. Technical efforts alone will clearly not be adequate to the task, though appropriate technical measures ought to be employed. The following points represent an emerging consensus on the technical side of software protection:

- No purely technical approach to software protection can provide a total solution to the problem of software piracy. There is no technical panacea.
- Any technical protection scheme can and will be cracked by technical means.
- The goal for technical protection should be adequacy, rather than completeness. Control of software piracy depends on a multi-pronged effort which balances technical, educational, legislative, and legal enforcement components.
- Whatever technical methods are employed must be minimally burdensome to the user and appropriate to emerging personal computer technology.
- There is a need for software protection, but these standards must be open. Software companies should and must free choice in the selection and implementation of protection technology.

Technology vs. Attitude

Everytime a so-called "unbreakable" software protection scheme has been examined by experts (at Lotus and other places), relatively modest efforts have succeeded in cracking it. State-of-the-art bit copiers are capable of reproducing even disks that have been physically modified so as to be supposedly uncopiable. Exotically named methods such as the laser hole, "weak bits," and "crap in the gap" fail to deliver the absolute protection they promise. Just as the U.S. Patent Office no longer examines applications for perpetual motion machines, the prudent software company shouldn't take seriously any more totally technical solutions. There is no such thing.

Users have a fundamental right not to be burdened by technical protection. With the widespread availability of hard disk based personal computers for the business market, complaints are growing that the need to insert a specially encrypted floppy disk at the beginning of a program session is simply not acceptable. The day is not far off when many users may not even have floppy disk drives because they will be doing their personal computing on a workstation attached to a local area network system with shared storage.

Software providers have an obligation to evolve protection methods that are more appropriate to these new environments, not merely more absolute. Fortunately, the industry is beginning to take its responsibilities seriously. New standards for technical protection are beginning to emerge through the work of industry trade associations such as ADAPSO.

As the software industry matures and more fully meets its obligations to users, it is reasonable to expect users to play by the rules by not participating in software piracy and not condoning it in the organizations in which they work. Stronger corporate anti-piracy policies are clearly required. Software companies will take the initiative, not only in technical protection, but also in stimulating a societal awareness of the mutual obligations of buyers and sellers. Only a strong climate of public opposition to piracy as a moral issue will be sufficient to bring the problem under control. I am optimistic that efforts made in good faith by all parties will result in an atmosphere in which more software piracy is no more tolerated than shoplifting or any other form of theft. ■

COMPUTERS: THE MYTH, THE PROMISE, THE REASON/KEN WILLIAMS

Sierra On-Line (my company) has been publishing home computer software for four years now. I remember when I got into this business projecting that *everyone* would have a computer within five years. Now that four of those years have passed I find that home computers have failed my expectations miserably. There are 92 million households in just the U.S.A. Of these, fewer than 2 million have home computers. Worse yet, many of the 2 million wonder why they bought computers in the first place. In this article I want to reconcile my prediction with the disastrous results and make some predictions for the future.

Before I begin I should clarify what I am talking about when I use the term "home computer." I divide computers into four categories; dedicated computers, business/office computers, game machines, and home computers. Dedicated computers are

Ken Williams, who is not yet 30, has enjoyed a ten-year career in the computer field, with extensive technical experience with mainframes and microcomputers. He was instrumental in the creation of five companies: Financial Decisions Systems, a firm that provides financial modeling and corporate tax return preparation for about 100 of the Fortune 500 companies, including General Motors; Softsel, the largest U.S. software distributing company in the U.S.; Softline, *a computer magazine; and Calsoft, a national mail order retailer of home computer software.*

His most recent and most successful venture is Sierra, founded in 1980 with his wife, Roberta Williams. The Company is now the largest independent publisher of home computer software, offering entertainment, education, and productivity lines. Williams has written college textbooks on microprocessor graphics, including Apple II Computer Graphics. *Williams, who graduated from high school at 15, attended California Polytechnic Institute in Pomona and studied marketing and business law at Valley College in Van Nuys, CA. He and his wife live in Coarsegold, CA with their two sons.*

the processors that control your microwave oven, car, and TV set. Whether you know it or not, you probably have dozens of these around your house that you use every day.

Business/office computers to me are computers used as part of a profession. Applications vary from a realtor operating out of his home on an Apple to General Motors doing their tax returns on a multi-million dollar mainframe.

Video game machines are computers used primarily for home entertainment. The Atari VCS-2600 and the Mattel IntelliVision typified this category.

A home computer is used in the home to do personal things such as educating your children or balancing your checkbook. Perhaps it is used for playing games, but that is not its principle use. Using a home computer to play a game that is strictly eye/hand coordination is like buying a car because it looks pretty in your driveway.

You may have heard rumors that 20 million home computers have been sold. Those rumors are wrong. My guess is that 20 million game machines have been sold, zillions and zillions of dedicated computers have been sold, 5 million business/office computers have been sold, and only 2 million home computers have been sold. That doesn't mean that 20 million people didn't think they were buying a computer. Herein lies a big chunk of the problem.

Only Three Home Computers

The only mass marketed home computers on the market today are the IBM PCjr, the Apple II, and the Commodore 64. Frankly put, if it doesn't have at least 64K of RAM, a keyboard, and a disk drive it doesn't have the hardware potential to be a home computer. As for software, if it isn't one of these three, I doubt you'll be able to buy enough software to satisfy you. The Atari 800XL would be the only possible fourth I know of. Perhaps the TRS-80 if I *had* to list five. But the rest of you who bought Timex/Sinclairs or NECs or IBM PCs, forget it, perhaps the machine is OK in another category, but it is not a *home* computer. Most machines fit into several categories. For instance all of the machines I recommend are OK as game machines *and* business/office computers.

OK, now that we all know what I consider a home computer, let's look at why the numbers are so small. What about price? A Commodore 64 can be bought if you look around for $199. For another $249 you can add a disk drive. From 1979 to 1980 more than 10 million game machines were sold in this price range. The price is not too high if people believe in and understand what they will get. People understood video games; they were a cute new form of entertainment. They spent.

Some forms of entertainment like Monopoly last forever. Video gaming apparently was closer to the hula hoop to people. The novelty wore off. I'm not sure whether the video game industry is dead or just evolving into a new form. The current crop of video game machines limits game expression too much. More versatile machines must exist for this industry to live forever. It is rather like having a record player that plays only 50's rock music. Not bad, but you gotta roll with the times or die.

I could write a book on the video game industry. A bigger more complex problem though is the home computer industry. I don't understand how a home computer is justified at home yet, and I have ten. My family spends fewer than two hours a week on our home computer and could certainly live without it. Therein lies the real problem. Appliance or boat anchor? That is the question.

There are three obvious uses for a computer at home: education, entertainment, and productivity. Let's examine how well home computers perform in each of these areas.

Education

For education I think we have to look at those we are trying to educate and why a home computer might be a better means of educating them than more conventional means. I'll divide the family into pre-schoolers, 5- to 18-year-olds, and adults. Up to age 3 I'm not sure kids have the mental capacity to learn much more than just what life throws at them. Furthermore, current computer I/O devices such as keyboards and televisions aren't appropriate to this age group.

I consider the year prior to kindergarten a critical year in preparing a child for school. A child who begins school already confident and able to manage his tasks easily has a tremendous headstart. I read once that some lunatic had advanced the theory that "All men are created equal." Well, maybe everyone started equal in your family. But not in most. Sometimes even in the same family one child can be a great reader while another is great at math. Conversely, sometimes a perfectly bright child can have problems with the fundamentals of up and down. Worse yet is the bright child who has

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the capacity to read but won't be taught how until third grade "because that is what the curriculum dictates."

The American school system, among the best in the world though it may be, is paced to move at a rate that keeps it first ahead of the slowest and well behind the smartest. I know, I was an early reader. I spent 12 years sleeping through school then hiking five miles to a public library to "push" my education. What children without the determination I had do I don't know. (Forgive me being emotional through just one sentence, I promise not to do it for the rest of the article.) I do not curse schools, they do their best. But I do thank God for computers!

At the 5 to 18 age level, software is needed to reinforce the information introduced in the schools. I never understood economics until I ran a computer simulation that allowed me to pretend to run my own country and manage its affairs. History need not be just a collection of facts to be memorized anymore. Rather, through the magic of computer simulation, a child can pretend to be Abraham Lincoln dealing with his problems. A computer is like having your own personal tutor who is an expert on everything and able to help you learn at your own pace without ever laughing at you or accidentally presenting material faster than you can absorb it. In fact, the computer is programmed to make sure boredom doesn't set in while you learn. Using a properly programmed computer, your children will fight to learn.

At the adult level, the computer can make learnable subjects that never could have been taught any other way. Most of us can't afford to learn to fly. Some of us want to experience the feeling. It is easy if you own a computer. Subjects such as auto repair, interior design, and almost anything including career training can be taught better on a computer.

Entertainment

Home computers have tremendous potential in home entertainment. For me there is a large area of fuzziness between education and entertainment software. Educational software on a home computer doesn't have to be the simple mindless games usually seen on video game machines. Sierra's games typically challenge the player's mind as well as occasionally his wrist. This is possible due to the far greater capacity and computing power of the computer. I suspect that computers will be found to be a much more involving form of entertainment than movies or books. Why watch or read when you can participate?

Productivity

Home productivity software refers not just to word processing and record keeping. Computers have far better uses in the home than that. Computers can help you lose weight, help keep track of your time, help you plant and maintain your garden, help improve your sex life (I won't elaborate), help prepare you for taxes (not *just* do the return), help keep you within your budget, help you choose investments, help you lay out furniture, pick curtains, mix paint and thousands of other things.

> *There are three obvious uses for a computer at home: education, entertainment, and productivity.*

I am not saying the computer will teach you to do these things. If you want to learn how, of course, the computer can teach you. More important, though you don't always *want* to learn how. You just want the job done. The computer already knows how, just tell it what you want, and let it figure the solution.

Home productivity means making better use of your time, not spending hours feeding a computer only to have it regurgitate the same old stuff you gave it in a new sequence. Trust me, good productivity software does exist.

A Lesson in Marketing

Of these three categories education alone justifies the presence of a computer in every home. When combined with the other categories, who could not demand a computer. So where is the problem? For the answer let's look at a statement made by a top marketing executive at Atari to the *Wall Street Journal* on June 1, 1983:

"Atari . . . is switching its advertising strategy. Instead of, say, depicting a child learning French on an Atari, the new ads will debunk competitors."

Now do you understand why people don't know why they might want a computer? Our own industry isn't concerned with why you might want a computer or what you might use one for, just that you buy. I don't blame hardware manufacturers for this type of advertising. They have to sell their machines by comparing them to the competition. Unfortunately, this leaves no one to tell people why they want computers.

There's another, bigger problem. It is the software. Because of the small number of home computers, software must be built to please everybody. It is expensive to develop software. All software must be developed to reach the widest possible market. If your software applies only to men or only to women, you have already lost half of your potential customers.

To give you an example we developed an educational game, *Learning with Leeper*, for 3 to 5-year-olds. This product received many awards as best educational product of 1983. Unfortunately, of those 2 million households with computers fewer than half a million have children in this age group. Our sales indicate an unbelievable penetration of this target group; however, *Learning with Leeper* has never appeared on a best seller chart. Our development cost on *Learning with Leeper* was higher than on most of our games. Clearly, we don't break even until lots of units have sold. I don't really make money until a product "hits the charts."

Another example: we designed a fantastic diet and exercise system. The project was scrapped because there are too many skinny people. I am pushing forward on a gardening program as my donation this year to people who are not generic. As to even more narrow applications like help in completing Boy Scout projects or painting your house, forget it. The market is too small.

Where does this leave us? Most of the great things I said a computer can do don't exist *only* because not enough people have bought computers. Sierra is one of the biggest software publishers around. Even when a project is justified it takes us a year to get it to market. We only publish about 15 new products a year. It will take time for computers at home to reach their potential. Be patient, encourage your friends to buy computers. When there are 10 million computers in homes I promise all these great things will be there too. ■

OF PASSION AND PET PROJECTS/ PETER McWILLIAMS

Born and raised in Allen Park, a suburb of Detroit, MI, Peter McWilliams began writing poetry as a high school student. At the age of 19, he dropped out of Eastern Michigan University to make his fortune as the "paperback Rod McKuen." After two years of struggle, the poetry took off; nine volumes of his poetry are in print with sales of almost three million. A self-confessed terrible typist and lousy speller, McWilliams invested his savings in a NorthStar Horizon computer, a NEC 5510 Spinwriter, plus WordStar *and* Word Plus *programs and then wrote a 3000-word article on word processing.*

After 16,000 words, McWilliams realized that he had a book and sent 18 publishers three chapters and an outline. The few who were interested in the book weren't convinced that it was timely. In self defense, McWilliams published the book himself in May 1982 under the Prelude imprint (named after his car). When sales passed the 50,000 mark, McWilliams signed a distribution agreement with Ballantine, one of the 18 houses to turn down the original manuscript. Five printings and 100,000 copies later, McWilliams began his next book, The Personal Computer Book, *which has sold 240,000 copies. He also writes a weekly syndicated column on computers.*

We all have our weak spots, our passions, our pet projects. For some, it's Mom and apple pie. For others, it's Haägen Dazs. For still others it's jogging.

I'll tell you my preoccupation: computers for the disabled. I am not rational about this subject. I am too excited. I believe too deeply. Stand clear, brothers and sisters, for I am about to testify!

Consider the following: For the deaf, it is as though the telephone has just been invented. For the first time they can call anyone who has a computer and just *chat*. For the blind, computers allow intricate word processing without the assistance of a sighted person. For paraplegics, quadriplegics, people with cerebral palsy, muscular dystrophy, and all the other disabilities and diseases that effect motor control, personal computers can make the difference—depending upon the degree of disability—between productivity and nonproductivity, between creating and noncreation, between communicating and no communication at all. For the emotionally and mentally disabled, computers offer friendly, nonjudgmental, infinitely patient educators, taking those with learning disabilities as far as they want to go as fast as they want to go there.

But you already know all this. There has been article after article on how wonderful computers are for people with disabilities. It is an accepted fact of computing these days, like the fact that word processing is better than typing, or Pac-Man is more fun than Chutes and Ladders.

What Can You Do?

What you might not have realized is the role that *you* can play in making computers available and useful to the disabled community. If you know how to operate a computer, you can change a disabled person's life. It doesn't take much time or much effort, and the rewards are disproportionately high. (Oh my goodness, I sound *just* like those public service announcements they show on television late at night when they run out of commercials.)

All you need do is something simple, like spending an hour or two a week showing disabled people how to run the program you know best. Or choose one disabled person who is planning to buy a computer and help in the selection, purchase, set-up, and training. Or donate that extra computer (do you have a Vic-20 or a Timex/Sinclair gathering dust?) to a disabled center. Or, well, be creative. This *is Creative Computing*, isn't it?

If you are one of those people who have gotten rich from computers (if you are debating the purchase of your fourth Porsche or staging a major rock concert in the Mojave Desert, I'm talking to you) you could be canonized by donating a few million dollars worth of computers to disabled people. It is also tax deductible, if you work it right.

But I warn you, all of this is addictive. When you see that a computer can fundamentally *change* the life of a disabled person, it will be hard to rest until *every* disabled person has one.

The Reverse Nobel Theory

Let me tell you about two of these people, just so you'll know what you are getting into.

I spent most of this evening talking with an aerospace engineer for Rockwell International. He worked seven years on the space shuttle program and was launch director of the first five flights. He designed 43 of the 47 control panels in the cockpit. ("When you push a button in a weightless environment," he asks, "How do you know if the button will be pushed in, or if you will be pushed away?" I am going to sell that to the local Zen Center for their book of Space Age Koans.) He has won four Astronaut's Awards (the coveted "Silver Snoopy") for professional excellence.

> *If you know how to operate a computer, you can change a disabled person's life.*

His name is Gerry Schwartz. Although his list of NASA and other aeronautic achievements goes beyond impressive and on to staggering, we spent very little time discussing

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manned flight.

What we talked about was our mutual passion: computers for the disabled. The admonition to beat swords into ploughshares is being faithfully followed by Gerry. "They are working on a bomber that will fly at nine Gs and deliver a nuclear missile with zero inaccuracy by voice command alone."

It seems that at nine Gs, a pilot

Gerry is applying the bomber voice technology to people here on earth who are as immobilized as a pilot flying at nine Gs.

can move very little but his mouth, so the mouth becomes the tool for control. Gerry is applying the bomber voice technology to people here on earth who are as immobilized as a pilot flying at nine Gs.

Using the technology of war for peace, Gerry Schwartz calls the Reverse Nobel theory. Alfred Nobel, you will remember, took the millions he made from the invention of dynamite and distributed prizes for peace. Not necessarily the best way to go about it, as the history since the advent of dynamite will attest. Better, perhaps, to invent tools of peace for neither fortune nor recognition than to buy a place in history with the profits of war.

"I am trying to make my life help-oriented," Gerry says in his characteristically straightforward style. To that end he founded the HOPE Center (Hands Off Program Experience) in Huntington Beach, CA.

Voice-Controlled Word Processing

Gerry can make any computer do almost anything with voice commands alone. The number of words it can recognize is limited only by the available RAM. A 64K computer can recognize about eighty words. Word processing, for example, can be done with the basic commands (Open File, Delete Word), a primitive vocabulary (it, and, the, and so on), and the alphabet. Most words are spelled out one letter at a time, just as on a keyboard. The same could apply to accounting programs, spreadsheet programs, and to the writing of programs themselves.

There are several voice recognition devices on the market. Gerry Schwartz's gift is one of software and matching the computer to the user. He has three goals when helping a disabled person select a computer, and all three must be met for Gerry to consider the job well done.

First, the machine must be useable at once. (The computer will grow more useful as time goes on, but it should be able to do *something* right away.) Second, the purchase of it shouldn't destroy the disabled person's budget. Third, the system must have room for growth.

One of the most interesting uses is a computer program he wrote for a young man with cerebral palsy. At first, the computer accepted a broad range of pronunciations for the command words, but as the weeks went by, the acceptable range was narrowed, and, consequently, the young man's speech improved considerably.

When speech is not possible, Gerry arranges for the disabled person to communicate with the computer using Morse code. "Morse code seems to be the standard for certain disabled applications," I said.

"Yes," said Gerry, "But is it right? Is it the best, the most useful? It is what we tell the disabled to use, but I hope they will use it for a few months

Gerry seems to look forward to that day when the disabled people he works with will tell him not only what they need but how to best fulfill the need.

and come back and say, 'You idiot: why did you stick us with Morse code when this or that would work so much better?"

Gerry seems to look forward to that day when the disabled people he works with will tell him not only what they need but how to best fulfill the need. "What's right for them is what's right.'"

And it is that attitude—the joy of being wrong if a better answer can be found—that is known, I suppose, as the right stuff.

More Spin-Offs from Space

Walt Woltosz began his work with computers and the disabled in 1980 when his mother-in-law was diagnosed as having amyotrophic lateral sclerosis—ALS, or Lou Gehrig's Disease. She unfortunately died before the software and input devices could be fully developed, but the event had a profound effect on Walt's life, and the work continued.

Walt left his job as an aerospace engineer for United Technologies Corporation and started Words+, Inc. in Sunnyvale, CA.

Walt Woltosz developed a computer/software package called the Words+ Living Center. This sounds like a planned environmental community for writers, but is in fact a Radio Shack Model 4 computer with special software and input and output devices. It is designed so that even the most severely disabled person can communicate—slowly, but completely.

It works something like this: A sensor is placed on or near the muscle group over which disabled person has the most control. The only movement necessary in successful applications has been the tapping of teeth, the twitch of a thumb, the raising of an eyebrow, or the blink of an eye. When activated by the tap, twitch, raise, or blink the switch gives a single command, roughly translated as "This One."

On a screen is the alphabet, along with numbers and some punctuation laid out in a grid, five across and ten down.

I tried the Living Center with an eye switch. It is an infra red device developed by Walt's father. An invisible beam of light is reflected off the eyeball. When the beam is broken, by a blink or a squint, the "This One" signal is sent to the computer. The switch fits over the head and in front of the eyes, like a pair of racing goggles.

A pointer starts at the top and travels down, stopping for a moment at the first letter of each row. After all ten rows are visited, the pointer returns to the top and makes the trip again. A blink at any row causes the pointer to

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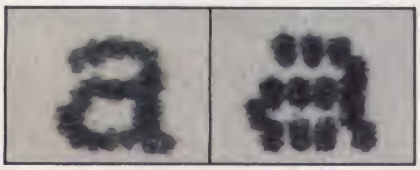

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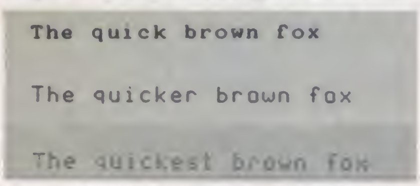
dot matrix printers is our printhead. It has 18 pins. Compared to the usual nine. It also has true dual-pass printing. The result: an amazing 240x240 dots per inch.



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CIRCLE 178 ON READER SERVICE CARD

travel horizontally across the selected row. A second selects a specific letter, and a new screen appears.

The new screen has 50 words on it, all of which start with the letter chosen, and is arranged in the same five-across-ten-down format. The pointer continues its vertical search, and a blink causes the pointer to travel horizontally across the chosen row. A second blink selects a specific word. The

The Words+ Living Center allows people with ALS and other severe disabilities to communicate with friends and loved ones longer than ever before possible.

word is added to the work area at the bottom of the screen, and the top of the screen returns to the alphabet.

In this way, sentences are built, word upon word. It is slow—five to ten words per minute (about as fast as I type)—but considering the fact that complete thoughts and ideas can be expressed by someone who has control over the movement of just one *eyelid,* it is remarkable. One of the tragedies of ALS is that the mind remains clear and alert while all the methods of communication, including speech, are taken away. The Words+ Living Center allows people with ALS and other severe disabilities to communicate with friends and loved ones longer than ever before possible.

The + part of Words+ includes games, the ability to draw, a voice synthesiser, and on/off control for electrical appliances.

Anything Words+ makes can be adapted by Walt Woltosz and his associates for specific needs. He is a man dedicated to serving the disabled. Why did he give up an outrageously high paying job in aerospace for the non-paying (thus far) job of developing computer systems for the disabled? "You only go through life once, and you've got to do what feels best. Unlocking people's minds gives me the most satisfaction of all."

The concept of unlocking is one that carries through in his company logo, a key, and the company motto, "Unlocking the Person." ■

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Looking Toward the Future

In some sense, the computer industry is the industry of the future. All the tools that man has developed since monkeys came out of the trees to the present day are mechanical tools, with one exception—the computer. Here, for the first time, we have a tool that extends man's intellect. Yet how often do we think about the future impact of that incredibly important invention—its effect on us, on others, and, indeed, on all civilization?

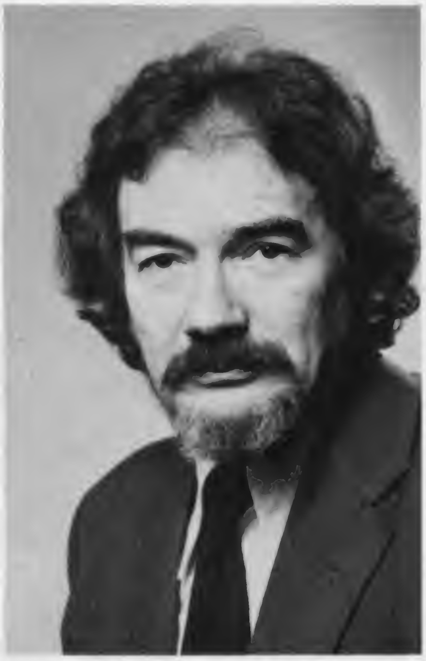
In this section, nine people who have been involved with radically different aspects of the computer speculate on its future impact. Tom Stonier sets the stage with his discussion of the emergence of the computer with respect to the overall growth of society. Clive Sinclair looks at not only possible future computer applications, but also other amazing machines that are likely to follow. Egil Juliussen projects the hardware and software capabilities of computers of the 1990's, while Ken Uston sheds his blackjack heritage and describes his idea for the perfect—well, almost perfect—computer of the future. George Morrow stays closer to the present and looks at the coming cashless society—both its benefits and risks.

Photograph: Lisi/Hoeltzell Cake: Larry Rosenberg

The next writer in this section is David Levy, a chess master who made a bet in 1968 that no computer would beat him for the next ten years. He speculates on the impact of the techniques of artificial intelligence on backgammon, reversi, and chess.

In addition to having a major impact on business and entertainment, Saul Bernstein believes that computers in the future will also affect education and fine arts. Stan Goldberg agrees and points out that we must concern ourselves now with planning for the most effective and beneficial use of computers in the future. ■

THINKING ABOUT THINKING MACHINES/ TOM STONIER



Tom Stonier is a New Yorker, who now lives and works in the north of England. He is professor and chairman of the Department of Science and Society at the University of Bradford in Yorkshire where he has been studying the interaction of science, technology, and society for several years.

His latest book, The Wealth of Information, *was published last year in Britain by Thames/Methuen. More recently, he published an article entitled "Information and the Deep Structure of the Universe." Stonier is also a founder and president of Applied Systems Knowledge (A.S.K.), one of the U.K.'s leading education software houses.*

In the course of history, human ingenuity has created many a wondrous device. None so marvelous, however, as the computer.

In that long road of human technology which, among other things, flaked stone; mastered fire; developed speech; domesticated plants and animals; forged bronze; created those great ancient civilizations and all the technology needed for them; invented Francis Bacon's famous trio—gunpowder, the compass, and the printing press — and then moved onwards to fashion the steam engine, balloons, factories, railways, steel, electricity, telephones, horseless carriages, airplanes, rockets, radio and television, and atomic energy, not to mention the myriad of less dramatic but frequently equally significant artifacts such as the stirrup, the nail, and the photovoltaic cell, in that long road, no invention will prove to be as profound as the computer.

Mastering the electron was as important as mastering fire. However, in only a matter of decades, exponentially growing electronic technology culminated in circuitry of such complexity as to create thought machines—machines that could manipulate information in a way previously possible only inside the human brain. The dreams of Babbage and other pioneers had come true.

These thought machines, computers, and their ancillary technology are propelling humanity into a new historical epoch. This article will look at the emergence of the computer in relation to four previous discontinuities: the Industrial Revolution, the Neolithic Revolution, the Hominid Revolution, and the Biological Revolution.

The Industrial Revolution

The Industrial Revolution initially centered on the steam engine and ancillary technology which mechanized the modes of production. The steam-driven factory system, in turn, resulted in urbanization and produced a profound shift in lifestyle. The steam engine represented an extension of the human musculature. A man with a steam engine could accomplish mighty tasks which were literally superhuman.

Similarly, the computer allows us to perform mathematical tasks which are superhuman. It can also perform simpler tasks such as deciding when a particular piece of machinery should be turned on or off, or in what particular plane a piece of metal should be drilled. Thus, the modes of production are changing once again — this time as a result of automation and the increasing use of robots.

Steam technology shifted Western economies from agricultural to industrial. Information technology is now shifting these same economies from industrial to information centered. The introduction of the computer into productive processes is therefore at least as profound as the Industrial Revolution.

The Neolithic Revolution

The Neolithic Revolution involved the domestication of plants and animals. To tend crops, one had to stay put; the introduction of farming technology meant that our hunter-gatherer forebears had to adopt an entirely new, sedentary lifestyle.

The computer has not only entered the work place, it has also entered the home. An increasing number of people are beginning to make their homes their work stations as information/communications technology permits working via telephone, facsimile, and satellite links. In addition, the computer will assure a dramatic shift in the way we educate our children.

The computer represents the first genuine revolution in education in more than a century. A century ago, there was a move to mass education, to get away from education for the elite only. That was a genuine revolution. However, the classroom of today is merely an extension of the Victorian classroom. Cheap home computers,

coupled with the flood of good educational software which will emerge during the 1980s, will change all that.

The efficiency of computer-based education will become evident in years to come. Most of the traditional information skills, such as reading, writing, and arithmetic, will be learned in the home. So will introductory levels of a wide range of scientific, sociological, and humanistic disciplines.

The function of the primary schools will be to encourage children to play with other children, to engage in sports, to work with machinery, to go on field trips, in short, to learn social and physical skills. At the secondary school level, the function of the teacher will be to help the student explore knowledge. Teachers and students will enter into a relationship of colleague and junior colleague; the teacher will act as a knowledge counselor or information guide. Most of the pupil's time and energy will be spent on projects of his own choosing.

The computer has already established itself in the home as a source of recreation and entertainment. In the future, it will be used for electronic funds transfer; tele-shopping; cooking; controlling light, heat, sound, and other systems; and as discussed above, for work and education. The nature of the home will change substantially. Unlike the steam engine, the computer is entering the home directly. The Computer Revolution is therefore at least as significant as the Neolithic Revolution.

The Hominid Revolution

The presence of the computer in the home and the emergence of home-based education, will have a further impact. Boys playing football, girls jumping rope (or vice versa), games, parties, and discos—these are all fun. We have overlooked the enormous educational value of these activities in teaching both physical and social skills. In contrast, our Victorian Puritanism has made learning intellectual skills, most of the time, into an onerous task. The computer will reintroduce fun into the process of learning.

The high motivational state induced in children working with good educational software coupled with the emergence of a global network of databases which allow the child access to information with unprecedented ease, must have an impact on the understanding children develop of the world they live in, and for that matter, on their understanding of themselves.

Furthermore, children encouraged to write their own programs will develop intellectual skills of precision, logic, a systematic and orderly fashion for producing work, and a much more sophisticated approach to the methods for solving problems. The cumulative improvements in intellectual skills coupled with their markedly expanded understanding of the world, will differentiate such children almost to the extent of being a new sub-species: *Homo sapiens cerebrus* or some such.

> *Children encouraged to write their own programs will develop intellectual skills of precision, logic, a systematic and orderly fashion for production work, and a much more sophisticated approach to the methods for solving problems.*

The matter is analogous to a situation several million years ago, when our pre-human hominid ancestors began to use weapons, both to ward off predators and to subdue prey. That earliest of all technological revolutions differentiated the hominid stock from the rest of the primates. The hominids were able to extend their econiche to hunting large game. In due course, as they mastered fire, they were able to extend their geographic range more successfully than any other primate. In human history, it was always those who were able to develop and use new technologies adroitly who in the long run not only survived better, but came to dominate the others.

Homo sapiens cerebrus will survive, prosper, and in due course dominate all those who do not partake of the new intellectual technology. Among higher organisms, new behavior patterns rather than new anatomical features set the stage for new patterns of evolution. The computer is setting the stage for a revolution as profound as the hominid revolution of so long ago.

The Biological Revolution

Lastly, we must look at the full implication of having created thought machines. For although there is an enormous resistance to the idea that computers can think, in fact, we have created devices that are able to carry out intellectual tasks previously carried out only inside our own heads. It is true that many of these operations reflect only some single capacity, but then, if one looks at mathematical capabilities, for example, the thought machines of our creation are able to work way beyond human capabilities.

Sooner or later, as we learn more and more about the functioning of the human mind and its capacity to manipulate information, we will be able to extend computers to cover all mental faculties in a similar manner. This will include the ability to deal with complex issues whether they be of the economy, of human relations, of the intellect, or of our emotional make-up.

This is a devastating blow to our ego. It is at least as bad as discovering that the earth is not the center of the universe, or that we are descended from animals. The last bastion of human egocentrism is that we can understand things better than anyone or anything else.

We are in for a rude shock. We have initiated an irreversible historical process of creating *machines* more intelligent than we. Primitive though this machine intelligence may be at the moment, it would be the height of blindness not to see how, over the next few decades, centuries, or if need be, millenia, these machines will have their information manipulating functions improved way beyond their present capability and way beyond human capabilities.

No steam engine ever designed another steam engine. Computers, on the other hand, are used to help design the next generation of computers. As both the circuitry and the algorithms become more and more complex, will there not come a time when the computer first surpasses, then no longer requires the intervention of humans in order to achieve replication?

Creative Computing is celebrating its first decade. Electronic computers

are only about four decades old, and microprocessors half that age. Biochips have not yet been invented. Not to envision self-replicating thinking machines is like looking at an airplane in 1910 and proclaiming it will never reach the moon. The question is not whether machine intelligence will surpass human intelligence at some future time, but what will be the relationship between human and machine intelligence.

Three billion years ago, in that primordial, organic soup which covered the surface of this planet, this part of the universe developed the new form of organization of matter and energy that we call *Life*. The precursor to life was the emergence of complex, self replicating molecules. The question that one might reasonably ask in 1984 is whether the combination of two unique phenomena: human society and thinking machines, might not set the stage for the next step in the evolution of this part of the universe from Life to Intelligence. Might not the emergence of machine intelligence with in human societies be as important in the near future, as was the emergence of complex self-replicating molecules within that primordial slime in that distant past?

Many people will shrink from this possibility in horror. The implications are that humanity has begun to evolve beyond humanity! It is not an unnatural reaction to wish not to move into the unknown. There is no reason, in fact, why we should move into it in a hurry. However, not to move forward is equally fallacious.

Along that long road of technological evolution, the human condition steadily improved. Even if, like fire, technology always posed a threat as well as a blessing, we never stopped, nor turned back. One of the earliest commentators on the computer revolution was the late Chris Evans. In his lifetime, he saw a great deal of what was fiction—science fiction—turn into reality. Men walked on the moon, robots emerged . . . In his book *The Mighty Micro*, he reviewed Alexander Korda's movie version of H. G. Wells's *Things to Come*. In pointing to the moral of Korda's film, he provided us with the guideline we must follow:

" . . . once man has taken the first step down the path of knowledge and understanding, he must take all those that follow. The alternative is to do nothing, to live with the insects in the dust . . ." Amen. ■

PREDICTIONS ON OUR COMPUTERIZED FUTURE/ CLIVE SINCLAIR

Sir Clive Sinclair, 43, founder and chairman of Sinclair Research Ltd., based in Cambridge, England, began his career in electronics as a technical journalist. At 22, Sinclair founded his first company, Sinclair Radionics. Beginning with radio and amplifier kits, he developed a reputation as a pioneer in the consumer electronics field, starting with the Executive pocket calculator in 1972 and the Microvision pocket television in 1977.

Sinclair Research Ltd., Sinclair's current company, designed and developed the ZX80 and ZX81 computers as well as the new QL computer. Total sales exceed three million units. Sinclair has entered a second market with a flat screen pocket TV; other current developments include computers, peripherals, and consumer applications of solid state technology.

Four thousand million years ago, when the universe was only half the size it is now and the solar system only five million years old, a singular thing happened—life. By some ineluctable process in the primordial soup, stirred by fierce cosmic rays and bolts of lightning, carbon compounds of strange complexity formed and reformed, growing in subtlety until they came to transmute sunlight and to replicate. For a billion years these first bacteria, so mysteriously conjured, clumping together to form living reefs called stromatolites, were the only life. Yet three billion years later they evolved into mankind.

I said that the event that started this process was singular and so, for all we know, it was. But so it will not long remain. All life is carbon based and carbon is exceptional in the variety of compounds it leads to, providing organisms with a rich choice of building materials. If we ever discover life on other planets we would not be surprised to find it similarly based on carbon, but it might not be so.

When I was a boy I read science fiction stories and in those days a common theme was the discovery of a life form strangely different from ours. A popular idea was for life based not on carbon compounds but on silicon on the grounds, I believe, that silicon too can form a wealth of products, many of them physically useful. Soon, I suggest, those stories will seem strangely prescient, for silicon based life will exist. It will not have emerged from millions of years of trial and error in energetic protoplasm but from a mere century or less of man's endeavour. I am suggesting that the path the silicon based electronics industry is on will lead to life.

Sinclair ZX80 with optional 16K memory and keyboard overlay. March 1981.

The human brain contains, I am told, 10 thousand million cells, and each of these may have a thousand connections. Such enormous numbers used to daunt us and cause us to dismiss the possibility of making a machine with human-like ability, but now that we have grown used to moving forward at such as pace we can be less sure. Quite soon, in only 10 or 20 years perhaps, we will be able to assemble a machine as complex as the human brain, and if we can, we will. It may then take us a long time to render it intelligent by loading in the right software or by altering the architecture, but that too will happen.

> *Quite soon, in only 10 or 20 years perhaps, we will be able to assemble a machine as complex as the human brain, and if we can, we will.*

It think it certain that in decades, not centuries, machines of silicon will arise first to rival and then surpass their human progenitors. Once they surpass us they will be capable of their own design. In a real sense they will be reproductive. Silicon will have ended the long monopoly of carbon. And ours too, I suppose, for we will no longer be able to deem ourselves the finest intelligence in the known universe. In principle, it could be stopped. There will be those who try, but it will happen nonetheless. The lid of Pandora's box is starting to open.

A Look at the Present

But let us look a little closer to the present.

By the end of this decade, manufacturing decline will be nearly complete—with employment in manufacturing industries less than 10% in Britain. The goods are still needed, but, as with agriculture already, imports and technical change will virtually remove all employment.

Talk of information technology may be misleading. It is true that one of the features of the coming years is a dramatic fall, perhaps by a factor of 100, in the cost of publishing as videodisc and other technologies replace paper. This may be as significant as the invention of the written word and Caxton's introduction of movable type. But talk of information technology confuses an issue; it is used to mean people handling information rather than handling machines, and there is little that is fundamental in this.

The real revolution, which is just starting, is one of intelligence. Electronics is replacing man's mind, just as steam replaced man's muscle. But the replacement of the intelligence employed on the production line is only the start. The Japanese, with their ICOT program, are aiming to make computers that will deal with concepts rather than numbers. This has triggered a swift and powerful response in the American nation. There is a large joint program of development amongst leading U.S. computer companies. There is at least as large a DARPA program, and IBM, though it says nothing, may well have the biggest program of all.

Looking Ahead to the Fifth Generation

These projects are aimed at what are loosely termed fifth generation computers. These are really a new breed of machine entirely and will be as different from today's computers as today's computers are from adding machines.

Powerful as these new engines will be, they will not remain inordinately expensive thanks to progress in the semiconductor industry. Once available, they will start to replace human intelligence at ever higher levels of abstraction.

The simple microprocessor provides sufficient intelligence for current assembly line robots. As robots learn to see and feel, their brains will grow. Eventually, and not too far in the future, they will make decisions on the production line currently delegated to supervisors.

Outside the factory, we employ men's minds in two principal ways: as fonts of knowledge and as makers of decisions. The former of these attributes is now falling prey to the machine with the development of "expert systems" whereby the acquired knowledge of a man, an expert in mining for example, is made to repose in the memory of a computer. The transfer of data from human to machine mind is neither easy nor swift, but once attained it may be copied at will and broadcast. A formerly scarce resource can thus become plentiful.

The ability to reach wise conclusions, as we expect of a doctor or lawyer, from much or scant data will longer remain man's monopoly but not forever.

Fifth generation computers will share this prerogative. Tomorrow we may take our ailments to a machine as readily as to a man. In time that machine will be in the house, removing the need to journey to the doctor and providing far more monitoring of the state of health than it is now economic to provide.

> *It often seems that each new step in technology brings misery rather than contentment but this is because it brings change faster than benefits—and change, though often stimulating, is always disturbing.*

The computer as surrogate teacher may bring even more benefits. Today, and as long as we depend on humans, we must have one teacher to many pupils. The advantage of a tutor for each child is clear, and if that tutor is also endlessly patient and superhumanly well-informed we may expect a wonderful improvement in the standard of education. What, though, is the purpose if, in this imagined future, there are no jobs?

Curiously, we can find analogies in the past. Freemen of Periclean Athens led not such different lives as we might live, for where we will have the machines, they had slaves who served both teachers and as menials. Thanks, perhaps, to their fine education, the freemen of Athens seem not to have found difficulty in filling their time. Just as they did, we will need to educate our children to an appreciation of

the finer things of life, to inculcate a love of art, music, and science. So we may experience an age as golden as that of Greece.

Other Amazing Machines

Machines will be capable of replacing men in tasks requiring complex motor functions. Strangely, I think it may be easier to make a machine to teach mathematics or Latin than to make one to play tennis for the latter task calls for an astonishingly fine and rapid prediction and decision coupled to precise action.

But still it can and will be done. Not to relieve us of the pleasure of playing games but to relieve us of the monotony and danger of nearly as complex a task, that of driving a car. We took to cars for the freedom they conferred to travel from any one place to another at any time, secure from the elements. We have paid quite a price in the mortality of our peoples and the pollution of our lands. We have chosen to restrain these remarkable vehicles to much less than half the speeds they could readily attain to mitigate these two evils.

The future promises a better solution. I anticipate totally automatic personal vehicles still with all the freedom in space and time of today's cars, but guided by machine intelligence. They will be powered by electricity drawn from internal batteries in towns and on minor roads and on the highways from a main supply possibly inductively coupled into the vehicle.

These latter day cars will be well nigh silent and clean but, above all, free from human fallibility. They need not then be restricted to 55 or 70 mph on main roads. Speeds of over 200 mph should be safely and economically possible. Magnetic levitation might replace wheels with advantages in the quality of ride, in silence, and in the longevity of the vehicle which, having no moving parts would need no regular servicing. It is entirely possible that the performance of these vehicles will become such as to obsolete aircraft for all but the longest journeys and those over water.

The linking of the telephone to ever more sophisticated computing machinery is leading to major improvements in the service available. The latest of these is the cellular radio system of communication now growing in some American cities. I see this as a partial solution to the general problem of permitting people to telephone one another no matter when or where. It is but temporary economic restraint not technical fundament which bars us from the logical conclusion of truly personal telephones. Carried on or about the person, these wireless devices would allow us to telephone and be telephoned wherever we choose.

I would not need to know the whereabouts of the person I was calling, only his number, since this would be particular to him wherever he was instead of to a fixed instrument as is usual now. I believe this is achievable by an extension of the cellular principle in area and capacity, the latter requiring much finer granularity in the system. That is to say, the controlling transceivers will need to be far more closely spaced.

It often seems that each new step in technology brings misery rather than contentment, but this is because it brings change faster than benefits—and change, though often stimulating, is always disturbing. So it is and will be with the intelligence revolution, but here the benefits to come handsomely outweigh the trauma. Even our most intractable problems may prove soluble.

Consider for example the imprisonment of offenders. Unless conducted with a biblical sense of retribution this procedure attempts to reduce crime by deterrence and containment. It is, though, very expensive and the rate of recidivism lends little support to its curative properties.

Given a national telephone/computer net such as I have briefly described, an alternative appears. Less than physically dangerous criminals could be fitted with tiny transporters so that their whereabouts, to a high degree of precision, could be constantly monitored and recorded. Should this raise fears of an Orwellian society, we could offer miscreants the alternative of imprisonment. I am confident of the general preference.

Intelligent robots will also help to care for the elderly who might even find companionship. Sleeplessly vigilant, the robot could provide for normal physical needs and watch for medical problems.

As the intelligence of robots increases to emulate that of humans and as their cost declines through economies of scale we may use them to expand our frontiers, first on earth through their ability to withstand environments inimical to ourselves. Thus, deserts may bloom, and the ocean beds be mined. Further ahead, by a combination of the great wealth this new age will bring and the technology it will provide, we can really begin to use space to our advantage. The construction of a vast, man-created world in space, home to thousands or millions of people, will be within our power and, should we so choose, we may begin in earnest the search for worlds beyond our solar system and the colonization of the galaxy. ■

PERSONAL COMPUTERS IN 1990/EGIL JULIUSSEN

Egil Juliussen is chairman of the board of Future Computing Inc, an information service company that specializes in market research and business seminars for the office personal and home computer industry. Future Computing is a leading company in tracking product sales, analyzing industry trends, and providing market forecasts and perspectives on the personal computer industry.

Juliussen is the author of Future Computing's newsletter, Future Views, *and co-authors many market research reports. Previously Juliussen was a key strategic and product planner at Texas Instruments Inc. for microprocessors,*

minicomputers, and personal computers. In the last seven years he has done more than 100 papers, presentations, seminars, and lectures. He received B.S., M.S., and Ph.D. degrees in electrical engineering from Purdue University.

Personal computers have changed tremendously in the past few years—in hardware technology, software technology, as well as in sales and advertising. These changes will continue, and the capability of personal computers will be dramatically improved by 1990.

Personal Computer Capabilities in 1990

Technology advances will remain a major force in the personal computer industry. Three key technologies will have the most impact on how personal computers will look in 1990:

- Software based on artificial intelligence (AI) technology
- Mass storage devices based on optical disks
- Flat display technologies

Artificial intelligence is rapidly becoming a buzz word in the personal computer industry. There are numerous startup companies that are developing AI-based software for personal computers. Expert systems will probably be among the first applications. We also believe that tomorrow's integrated productivity software will gain ease of use through AI techniques. A few AI products are currently available on mainframe computers, but personal computers will be the major market for these products. The processing power and memory required to run AI-based products will help push personal computer hardware advances.

Figure 1 shows potential mass storage devices for the 1990 time frame. Optical disks have been a promising technology for 15 years but have been a disappointment so far. The investment in R&D and manufacturing for the videodisk and digital audio disk (compact disk) is rapidly changing the outlook for optical disks. By the late 1980s, Future Computing is projecting four categories of optical disks that will be used in the personal computer industry. At the high end of the spectrum is an optical read-write disk, which will cost about $5000. The optical read-write disk will have a capacity of approximately 1 gigabyte or 125Mb. A write-once optical disk will be priced in the $1500 range and will store 0.5 to 1 gigabyte. These two devices will probably be based on the current 12" video disks. A compact disk (CD ROM) would be based on the digital audio disk which has a 12cm (4.8") diameter. The CD ROM will cost $250 to $500 and will store 0.2 to 0.6 gigabytes. The format of the digital audio disk will offer a capacity of 550Mb on one side.

A smaller size read-only optical disk is also a possibility. Such an optical microdisk could have a 3.5" diameter and could store about 50Mb. The price will be in the $200 range. The read-only disks will be able to display digital and video images.

The magnetic disks will see continued improvements and will remain the primary mass storage devices. Vertical recording is likely to have a high impact on magnetic disk products. There will be 5.25" Winchester disks as well as microWinchester disks, probably 3.5" in size. The leading floppy disk will be 3.5", but a 2" version will appear. The 5.25" minifloppy disk will still be in use.

Flat display technologies will improve substantially in the next few years and will be a key in the growth of battery-powered personal computers. There are several other display technologies vying for dominance in the personal computer industry, but LCD appears to be in the lead due to its low power consumption. High investment in LCD manufacturing and R&D favors this technology as well.

There are other technologies that will impact personal computers in this decade. The laser printer will be the most important printing technology. Ink-jet printers, as typified by HP's Thinkjet printer, will also be important. Speech I/O is also likely to improve its position.

Office Personal Computer Capabilities in 1990

With these technology advances, we can sketch the typical office personal computer capability for 1990, as shown in Figure 2. The floppy disk personal computer will have at least 4Mb of RAM. It will have two microfloppy disks and an optical read-only disk (CD ROM). A color graphics display driven by a powerful graphics chip will be standard. This graphics chip will execute high level commands, such as rotation and windowing. The printing tasks will be handled by a multifunction printer which will handle graphics and various levels of letter quality printing. Communication via modem or with a local network will also be included. The primary software will be integrated productivity programs that have been enhanced by A I technologies. Windows will be common. The price will be in the $3000 range. The microprocessor will have 32-bit capabilities.

The Winchester disk personal computer will have even more capability in memory and mass storage. Program storage of 16Mb will be common. A microWinchester disk with 100Mb may be conservative if vertical recording is successful. The optical write-once disk may be used as a backup and archival device. The laser printer will probably be standard. The modem will also be faster than for the floppy disk personal computer. The typical price for this system is in the $7000 range.

All home computers will have a powerful graphics animation chip, which will be able to construct Saturday morning cartoons in real time.

Figure 3 shows a similar scenario for battery-powered personal computers. The book-size personal computer is constrained by its size. That is the reason for the small disk and the add-on printer. The book-size personal computer will finally approach the capability of the so-called Dynabook, which Alan Kay postulated while at Xerox in the early 1970s.

The book-size personal computer will have 1Mb of RAM and a 2" microdisk storing 400K and possibly more using vertical recording. The trick is to find the space for both the keyboard and the display. Some products will use touch input technology instead of keyboard. The integrated productivity software will have multifunction communications software for access to databases and for retrieval of information from the "mother-computer" back at the desk. Battery operation will be mandatory and could easily sustain 70 to 80 hours of use.

The briefcase personal computer is

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more capable and will run most of the desktop personal computer software. It must, therefore, have the same microfloppy disk as the desktop product and must also emulate the display characteristics of the desktop personal computer. The size constraints are not as severe as for the book-size personal computer. This allows the inclusion of two larger 3.5" disks and a printer. The low power consumption of ink-jet printers favors this technology. Some of the briefcase personal computers will have a microWinchester disk in place of one of the 3.5" floppy disks.

Home Computer Capabilities in 1990

The home computer capability of 1990 will increase dramatically over current products. For comparsion, the capability of Future Computing's two home computer segments is shown in Figure 4. The equivalent of a cartridge home computer will have 1Mb of RAM. A 2" microdisk or a 3.5" microfloppy disk will also be included. An optical read-only disk will be a common optional peripheral. A color TV interface will be a standard feature.

Figure 1

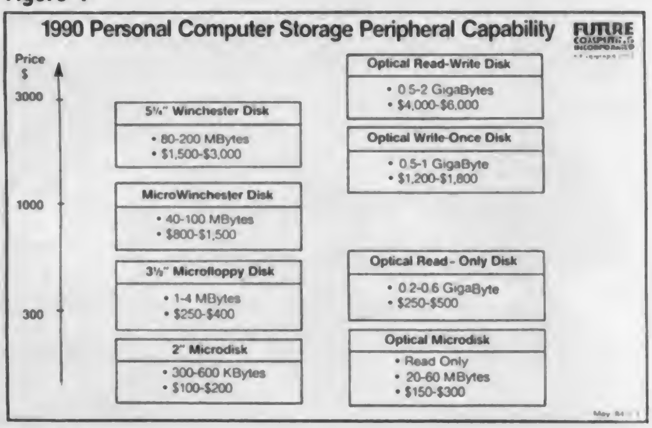


Figure 2

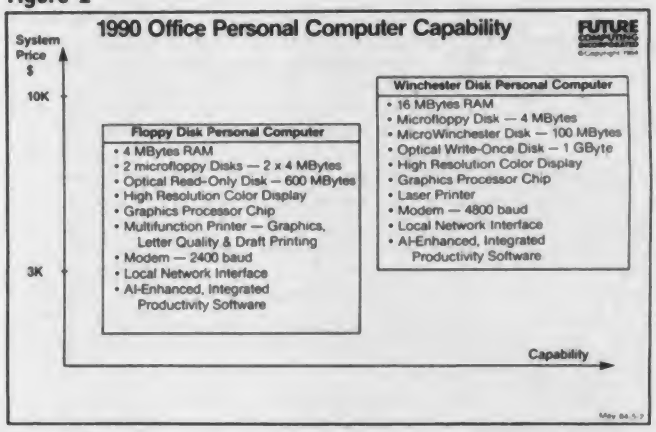


Figure 3

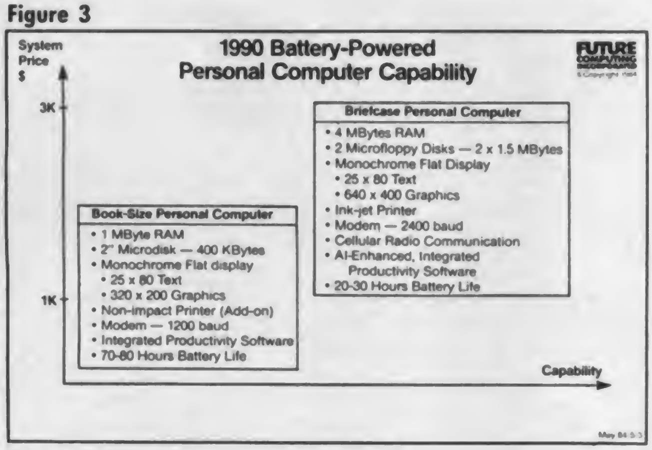


Figure 4

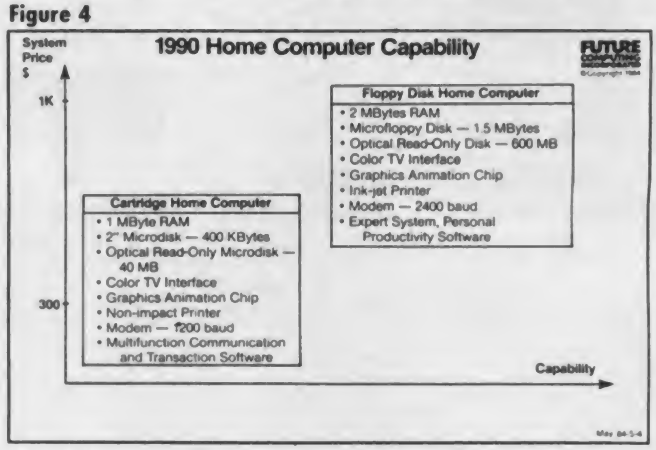


Figure 5

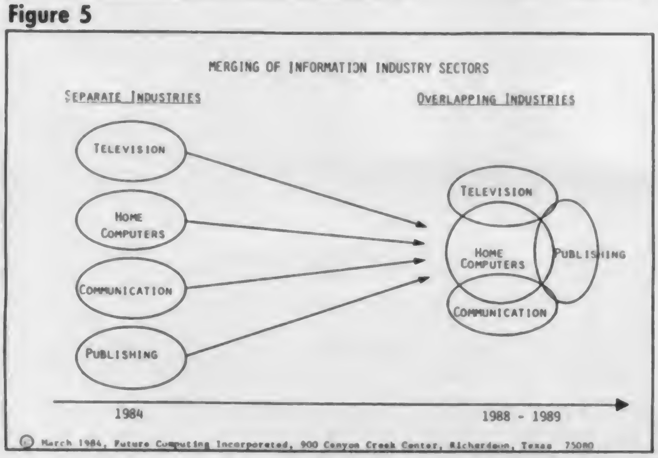
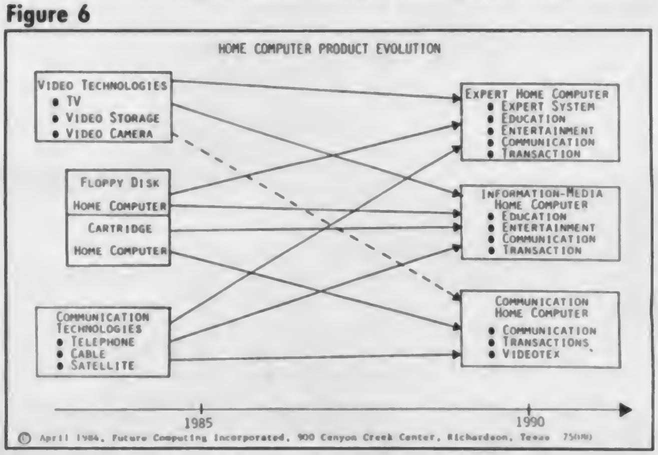


Figure 6



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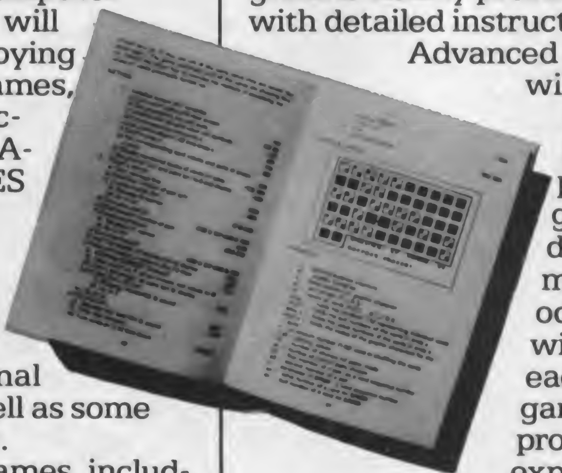

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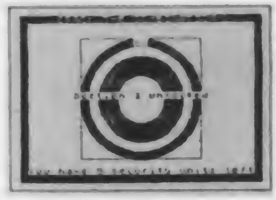

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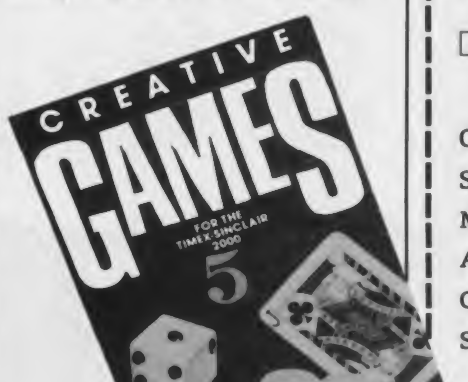

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All home computers will have a powerful graphics animation chip, which will be able to construct Saturday morning cartoons in real time—a capability which will provide tremendous entertainment and education software.

Output will be provided by a non-impact printer—possibly thermal transfer or ink-jet technology. A 1200-baud modem will be very common. It will allow multifuction communications and transaction software to become a major application. Future computing believes strongly that home banking, transaction, electronic mail, and videotex will become major applications by that time. These functions will make home computers a "need" in 1990 versus being primarily a "want" in 1984. This product will cost $300 to $400 in 1990.

The equivalent of the floppy disk home computer will have at least 2Mb of RAM in 1990. A microfloppy disk, probably a 3.5" disk, will be standard, along with an optical disk. The CD ROM will be based on the digital audio disk and may store more than 500Mb. The ink-jet printer is most likely to be the printer of choice and will provide both letter quality and higher speed draft and graphics output. The major software applications will include entertainment and education programs along with multifunction communications software. In addition, personal productivity software that behaves like expert systems will have a profound impact.

These advanced home computer capabilities will have a very significant impact on industries other than the computer industry as shown in Figure 5. Currently, the television, home computer, communications, and publishing industries are, for the most part, separate industries, each with a definable set of participants, products, and customers.

By the late 1980s these distinctions will blur as television, telephone, and publishing technologies merge with home computer technology. Home computers will incorporate all of these technologies, and thus become very different sorts of machines than exist today.

The challenge for firms in these industries is to change with technology; if they do not, they will fall behind competitors. The shift will be equivalent to the shift from vacuum tubes to transistors, and from mechanical adding machines to electronic calculators. In each case, some firms were able to adapt while others could not and disappeared.

The floppy disk and cartridge home computers of 1984 will merge with new video and communications technologies during the late 1980s. By 1990, three new classes of home computers will develop as seen in Figure 6: expert home computers, information-media home computers, and communication home computers. The expert home computer will include high speed communications and large storage for personal productivity applications, but will also be used for education, communication, and transactions.

The information-media home computer will upgrade the television set with storage for video, audio, and software and will become the home entertainment and education system of the next decade. By 1990, the TV receiver function will fit on a handful of integrated circuits. Thus, a small board that could fit inside a home computer could add the TV function.

The communication home computer will be compatible with the information-media home computer. It might also be used apart from the television for electronic mail, home banking, shopping, and database retrieval. This computer will incorporate the voice communications features of the telephone but will also play ROM entertainment and education cartridges and optical disks.

Summary

In 1983 the office personal computer market in the U.S. was nearly $8 billion at the customer spending level—including both hardware and software. The home computer hardware and software market in the U.S. was $2.5 billion in 1983. By 1990, Future Computing projects that the U.S. office personal computer hardware and software market will exceed $45 billion. And the 1990 home computer market will be nearly $14 billion. To put these numbers in perspective, a 1% market share of the U.S. office personal computer hardware market is worth over $350 million in customer spending. ■

THE HISTORY AND THE HOPE/KEN USTON

A Phi Beta Kappa Yale and Harvard M.B.A. graduate, Ken Uston left his "three-piece suit" job as senior vice president of the Pacific Stock Exchange in 1974 to become a professional blackjack player. He and his blackjack teams were so successful that they were barred from casinos in Las Vegas, Atlantic City, Europe, and the Orient. When Uston sued Resorts International in Atlantic City, the New Jersey Supreme Court supported his contention that skillful play was not legal grounds to bar him from the blackjack tables.

An admitted game addict, Uston has spent countless hours playing video games and has designed computer games, including PuzzlePanic *and* Ken Uston's Professional Blackjack. *He has written 16 books, including* Mastering Pac-Man. *Uston has just finished a nine-book series of computer guides for Prentice-Hall.*

Like many of the contributors to this anniversary issue, I wasn't even aware of personal computers when *Creative Computing* was founded in 1974. This is not surprising, of

course, since the first personal computer didn't appear on the scene until the following year, 1975.

It wasn't until 1982 that I became involved with personal computers—and with Dave Ahl. I was under contract to write a guide to personal computers, which was all well and good, except for one thing: I didn't know a thing about home computers. I had written some books on video games, and the publisher assumed that this made me a computer expert.

I met Dave at the June 1982, Consumer Electronics Show and told him about my dilemma. Dave agreed to help me research the computer book.

Just about everyone—bartenders, taxi drivers, waitresses—seemed convinced that he would soon own a home computer.

I spent the fall of 1982 in a Morris Plains, NJ, motel, commuting to the Creative Computing offices. Dave let me roam through the building trying out various computers and software packages.

1982 was the year—you probably remember—that *Time* magazine made the computer The Machine of The Year. The press in general played the home computer explosion up big. We saw front page stories in *USA Today* and *The Wall Street Journal* stating that everyone would soon have a home computer. Just about everyone—bartenders, taxi drivers, waitresses—seemed convinced that he would soon own a home computer, although no one seemed to know exactly why. It just seemed to be inevitable, The Wave Of The Future.

Then came December 8, 1982 when Atari announced huge losses in their Consumer Electronics Division.

Then it hit the fan. Mattel abandoned their Aquarius computer system. Texas Instruments withdrew the ill-fated 99/4A.

Media Backlash

Then came the media backlash. Suddenly, home computers were a myth foisted upon an unsuspecting public by greedy computer marketeers. The press predicted a blood-letting industry shake-out.

And the shake-out came, and it's still going on. We read a new chapter in the history of personal computers—Chapter II—and how Osborne, Eagle, Victor, Franklin, Actrix, and many others were using it to "protect" themselves from creditors.

In addition to the sheer economics of over-production, it seems clear that what happened was due to two primary factors:

• The manufacturers were (and are) producing products we didn't really need—products that often were solutions in search of a problem.

• Worse yet, the manufacturers made (and are still making) it so very hard for us to use computers, despite dozens of ads proclaiming "user-friendliness" (in itself a non-user-friendly term).

Frustration

I have been writing a series of books to teach how to use computers easily and simply. I've had myriad frustrating experiences trying to get hardware and software to work properly. To cite a few examples:

• I worked with an Actrix computer for six weeks before finding out that it could double space text (the company rep didn't even know that).

• It took me ten hours to tie a Commodore 64 into Compuserve, despite the salesman's assurances that it was a five minute job.

• It took five days and a dozen long distance calls to get a modem to work with an Apple IIe.

• My version of *Lotus 1-2-3* (Version 1) didn't work with an IBM PC. No one at Lotus Customer Service could help me. I even called company headquarters and talked to the guy who wrote the manual. The problem was beyond him, too.

• It took five calls to MicroPro to get my *WordStar* program disk to work. Page 1-3 of the *WordStar* manual supposedly told how to do this; it didn't. (There are, would you believe, three page 1-3's in the *WordStar* manual.)

• One software producer designed a simple tutorial on the C64, to make it very simple to use the Commodore 64—a great idea, except that the loading instructions didn't work.

• I tried for three days to get *Perfect Calc* working and, despite the manual, finally succeeded. On the fourth day, after laboriously constructing a spreadsheet, I inexplicably lost all my data.

There was a bug in the program. I called a customer rep and complained.

Her response: "Ken, welcome to the world of computers!"

The rep's response reflects exactly what is wrong in the industry. The manufacturers rely on us, the consumers, to adapt to the computer. *Wrong!* The computer must adapt to *us.*

"O.K.," you're asking, "What do you want computers to do?"

Well, let me tell you about a mythological computer that, if produced, might really be a solution. Let's call it Model Z.

Perfection in the Model Z

Model Z will be the size of the Radio Shack 100, weigh 4 pounds, and be carried around like a notebook. Some of its features:

The computer will probably have a 256-bit microprocessor. But you won't know or care; all you will know is that you never have to wait more than two seconds to get anything done.

• A durable keyboard with sculpted keys and ten function keys; the keyboard is detachable and works by remote control (no wires).

• 512K RAM—all usable, of course.

• All programs built-into ROM, so you won't need disks or other such troublesome devices to load programs.

• When you turn the computer on, you will see a menu listing: Write, Calc, Draw, File, Play, Teach, Talk,

SCRG

SWITCH-A-SLOT

$179.50

The **SWITCH-A-SLOT** is an expansion chassis, which allows the user to plug in up to four peripheral cards at one time. One of these cards is selected for use, and only that card draws power.

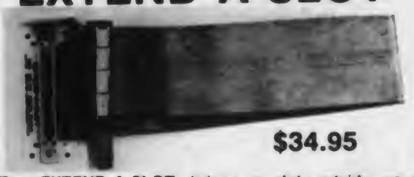
This product is especially useful where the software requires the printer to be in a particular slot, and the user wishes to choose between two or more printers.

- Allows up to four peripheral cards to be plugged into one peripheral slot.
- User selects desired card by front panel rotary switch.
- Only selected card draws power.
- Plugs into any peripheral slot.
- Saves wear and tear on delicate connectors.
- 18" cable connects Switch-a-slot to computer.

New—resistive terminations for better response

SWITCH-A-SLOT and EXTEND-A-SLOT work well with all slow to medium speed cards, such as Modems, Printers, Clock, 80 Column, Music, etc. They are not recommended for high speed data transfer devices such as disk drive controllers, alternate processor, and memory cards. These products may be incompatible with some alternate processor cards.

EXTEND-A-SLOT



$34.95

The **EXTEND-A-SLOT** brings a slot outside your APPLE™, allowing an easy change of cards. The 18" flex cable is long enough to allow placement of the card in a convenient location. The high quality connectors are gold plated for reliability.

The perfect accessory for:

Owners of large numbers of I/O expansion cards—keep your frequently used cards installed. Use the EXTEND-A-SLOT for the others.

Technicians—easy access to test points on accessory cards under actual operating conditions.

Experimenters—make easy changes to cards while card is installed.

EASY TO USE—just plug it in as you would any expansion card, then plug your card in. When you want to change cards, do it easily outside the computer, without the wear and tear on the computer expansion slot.

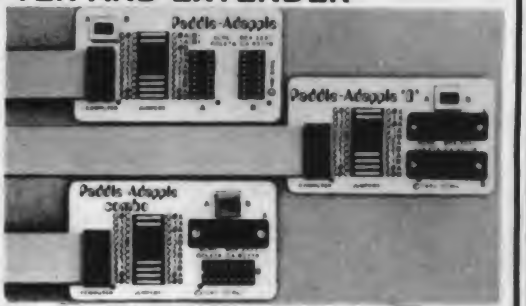
OTHER PRODUCTS

D Manual controller. Gives complete control over the $C000 through $C0FF range in hardware. Can be switched while program is running. $89.50.

MAGIC KEYBOARD (for][or][+ only). Re-encodes the keyboard to give alternate keyboards, such as DVORAK, ASK, 10-KEY, HEXIDECIMAL KEYPAD, etc. $49.50.

Paddle-Adapple

GAME I/O ADAPTER AND EXTENDER



- Works with all Apple compatible joysticks, paddles and other I/O devices.
- Select one of two devices or . . .
- Use 4 paddles simultaneously.
- Unique "Jumpers" socket allows you to configure to meet your needs.
- BPI™ users can have BPI™ device and paddles plugged in simultaneously. (**Paddle-Adapple** and **Paddle-Adapple Combo** only)
- Gives you four push-button inputs.
- Supports shift key modification.
- Exchange X & Y joystick axis.
- Small and compact — adheres to computer with supplied foam tape.
- All Strobes, annunciators and power available on all 16 pin connectors.
- Supplied with 18" cable.

$29.95

The **Paddle-Adapple** has two 16 pin sockets.

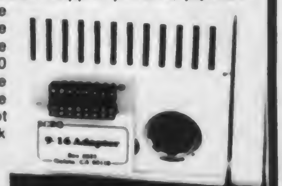
The **Paddle-Adapple "D"** works with the subminiature D connectors.

The **Paddle-Adapple Combo** has one 16 pin socket and one subminiature D connector.

NEW 9-16 Adapter

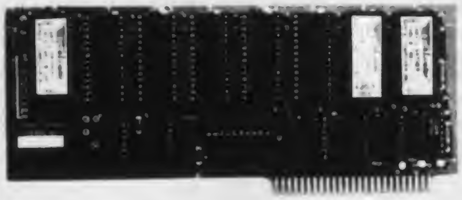
For Apple //e and //c

This product permits the use of most 16-pin I/O devices with the APPLE //c or //e. By plugging this adapter into the sub-miniature 'D' connector, you can plug in a 16-pin device, such as the Paddle-Adapple, paddles, joystick, KOALA PAD™, etc. The only limitations are those devices that use the annunciators or the C040 strobe, such as the POWER PAD™. Please note that the //c does not support four joystick inputs.



$14.95

quikLoader™



FAST AND CONVENIENT

The quikLoader is the *fastest* way to load programs. **BAR NONE!** Programs can be loaded in fractions of a second. More importantly, DOS is instantly loaded every time the computer is turned on. Integer is even loaded in the language card. This process takes less than a second, saving valuable time. Frequently used programs are available *instantly* when you need them, without having to look for the disk, or hoping that the lengthy disk loading procedure goes smoothly.

To run a program from the quikLoader, bring up the quikLoader catalog (Q-reset), and the names of the programs will be displayed, along with an index letter. Pressing the index letter will instantly load and run the program.

Up to 23 programs on the quikLoader can be displayed on the screen at one time. If you have more programs, you may scroll through the catalog in either direction.

The quikLoader is **ideal** for applications requiring a dedicated computer. Your program can be automatically loaded and run at "power-up".

PROGRAMMING EPROMS

Putting your own programs on the quikLoader is easily done, using a separate EPROM programmer such as the **PROmGRAMER**. For APPLESOFT, INTEGER, or single machine language files, no programming knowledge is necessary. You **will** need experience if you want to save copy-protected or complex programs. The amount of experience necessary depends on the complexity of the program.

COMMERCIAL PROGRAMS

If you have a program that is valuable, it will become **more** valuable when it is instantly available to you. We are actively seeking licenses from software publishers to allow their popular programs to be made available for the quikLoader. Independent authors are encouraged to write programs suitable for the quikLoader. If the author wishes, we will market the program (with appropiate royalties), or the author can take care of all marketing. In either case, we will make known to our customers the availability of these programs.

We start your library of programs with the most popular utilities on the card, FID and COPYA. Now, if you have to copy a disk, you don't have to search for the master disk. You can start copying within 3 seconds after turning on the computer.

We are currently licensed to sell several very popular programs on EPROM. **DOUBLE—TAKE** by BEAGLE BROS., and **COPY][PLUS** by CENTRAL POINT SOFTWARE. The introductory price for DOUBLE—TAKE is $45.00. This includes the program exactly the same as you would buy it at your dealer for $34.95 (including disk and documentation), and a programmed 27128 EPROM (worth about $25.00). COPY][PLUS cost $65.00. This includes the original program (worth $39.95) and **two** programmed 27128's.

Other programs available directly from us or the publishers are, **BARKOVITCH I/O TRACER AND SINGLE STEP TRACE, MICRO/TYPOGRAPHER** from **TIDBIT SOFTWARE, ECHO** speech synthesizer software from **STREET ELECTRONICS,** and **MERLIN** assembler, from **ROGER WAGNER PUBLISHING.** More commercial programs are now in the works.

MEMORY CAPACITY

The quikLoader has eight sockets for EPROMs. These sockets can accommodate standard EPROMs from 2716 to 27512. These types can be freely intermixed. The memory capacity of the quikLoader depends on the EPROMS used. For example, the 2716 can hold 2K of programs, and the 27512 can hold 64K. (Frankly, the current costs of the 27512 is prohibitive,but should come down drastically in the next year.) At this writing, the least cost-per-bit is provided by the 2764, which can hold an 8K program. Using these "chips", the quikLoader becomes a 64K ROM. Using larger capacity EPROMs allows it to become a 128K, 256K, or even a 512K card. If more memory capacity is needed, the quikLoader operating system supports multiple quikLoaders.

INCREASED DISK CAPACITY

Since DOS is loaded from the quikLoader every time the computer is turned on, it is not necessary to take up valuable disk space with DOS. This will give you more than 5% additional space for programs and data on your disks.

ABOUT THE DESIGNER

The quikLoader was designed by Jim Sather, author of UNDERSTANDING THE APPLE][(forward by Steve Wozniak), published by QUALITY SOFTWARE (21601 Marilla Street, Chatsworth, CA 91311 (818) 709-1721).

SYSTEM REQUIREMENTS

The quikLoader plugs into any slot of the APPLE][+ or //e. If used in a][+, a slightly modified 16K memory card is required in slot O. A disk drive is required to save data.

DOS, INTEGER BASIC, FID, and COPYA are copyrighted programs of APPLE COMPUTER, INC. licensed to Southern California Research Group to distribute for use only in combination with quikLoader.

$179.50

PROmGRAMER™

The **PROmGRAMER** will read or program any of the standard single-volt EPROMS from the 2708 to the 27512. Features include:

- Slot independent operation for the APPLE // family of computers.
- Zero insertion force sockets accepts 24 or 28 pin devices.
- Disk based software allows easy customization of software.
- Complete instructions for loading software into quikLoader.

$149.50

Available at your local dealer or direct from:

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Goleta, CA 93118
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TELEX 658340 ATTN: SCRG
Answer Back INTERTEL SNC
VISA, MASTERCARD accepted

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(800) 635-8310

all other states (including AK, HI, VI & PR)
Information & technical questions: (805) 685-1931

CIRCLE 220 ON READER SERVICE CARD

and News.

When you select Write, a blank screen appears, all ready for writing. Search and replace, a spelling checker, and other fancy word processing functions are all at your disposal.

Under the Calc option, you have your choice of built-in, pre-formatted spreadsheets (P & L, cash flow, personal net worth, etc.), which appear on the screen at a press of the Return key.

When you select Draw, the computer automatically creates a chart or graph of the spreadsheet. From the nature of the data it knows whether a bar chart, line chart, or Venn diagram is the most appropriate, and draws accordingly.

The Draw option also offers all the features of MacPaint, with one exception—you have a choice of 256 colors.

When File is selected, the screen displays a menu of all your personal files—income tax returns, bills due, mailing lists, whatever we want.

When you select Play, a menu of your favorite video games appears (my menu lists *River Raid, Pogo Joe, PuzzlePanic,* and *Ms Pac-Man).*

When you select Teach, you get another menu, which lists all the subjects you want to learn more about (these were pre-selected when you bought the computer). You could include such subjects as how to speak French, Italian, or Japanese, the history of all the countries in the world, and just about anything else.

When you push Talk, you see a menu of all the other computers with which you can communicate with one press of the Return key. (In my case, I will be able to select from *Creative Computing,* Prentice-Hall, and *Video Review* to zap articles or book chapters to them in seconds.) Naturally you can also be connected to the computers of friends across the country. Even if they're not home, you can type messages to them 24 hours a day.

When you hit News, a menu appears listing all the subjects in which you are interested, including the most up-to-date news from around the world (there is a menu of countries), interesting new video games, and what's new in home computer software.

The computer will probably have a 256-bit microprocessor. But you won't know or care; all you will know is that you never have to wait more than two seconds to get anything done.

The monitor is built into the computer. When the computer is turned on, the monitor displays four screens, each with 80 columns across and 24 lines down—in high-resolution color. Thus you can write, calculate, draw graphs, and file things all at the same time. Each function has its own separate window.

You will be amazed that they managed to fit those four screens into a notebook size computer (it is not inflatable). But you won't be concerned with the technical details.

There is a built-in four-color printer, and a buffer is built in, so we can use the computer while something's printing.

The input/output medium is a sturdy cartridge. You never have to worry about touching the shiny parts or spilling ketchup on it. Losing data from a cartridge is not a possibility.

Model Z comes with a mouse. We can also simply touch the screen to select from a menu or move the cursor.

There is a special Fix key on the keyboard. When we see an error message, we press the Fix key, and the error is corrected—no matter what it is.

A revised Model Z (due out in two months) has no Fix key, because error messages won't appear on the screen. The computer fixes its own errors. This upgrade will be free, which, of course, is only fair. After all, it is the computer's fault, not the user, if what it wants him to do is difficult or unclear.

The computer—complete—sells for $399. Now I know that sounds unrealistic. But it is not really that expensive if you consider that several other things are included with the system. There is a 12-hour battery pack, a personal letter from the head of the CAB authorizing you to use Model Z on all commercial airline flights, and a two-year warranty.

And finally, of course, you will get a Wico Command Control joystick as part of the package. ■

A COMPUTERIZED CASHLESS SOCIETY/ GEORGE MORROW

George C. Morrow is founder and chairman of the board of Morrow, Inc., maker of desktop personal computers and add-on boards and disk subsystems for S-100 bus systems. Morrow founded the company in his garage in 1976 as Thinker Toys. A self-trained logic designer, he created products including I/O, memory, and other S-100 boards. Morrow, Inc. entered the personal computer market in 1982 with the Micro Decision line of low cost computers.

Before 1976, Morrow lectured in calculus at the University of California at Berkeley (where he began designing and programming computers), worked as a technician at Shockley Transistor, and held more than 100 other positions, most of them as a short-order cook. He served as first chairman of the IEEE 696 S-100 bus standard subcommittee. He holds a B.S. in physics from Stanford University, an M.S. in mathematics from the University of Oklahoma and has completed the doctoral program in mathematics at UC Berkeley.

Our banks and financial institutions face two problems that are becoming more overwhelming with each passing day. First, they are drowning in paper. There is simply no practical way to cope with the amount

of paper needed to record and verify the millions of personal and business transactions taking place every day of the year.

Second, when transactions are not only increasing in number but involving much larger amounts of money than ever before, essential control over those transactions is lacking. There are more and more instances of bad check passing and non-payment of bills.

Banks already have begun to cope with the first problem through electronic funds transfer, one aspect of which we see every day in the form of the automated bank teller machine. This use of the computer has contributed to alleviating the paper overload somewhat.

But as yet little has been done to solve this second problem—control.

Here, too, the solution lies in the computer. As almost all of us routinely use credit cards to make purchases, we have already made a radical departure from our traditional cash-oriented society. A logical extension of this trend should bring us a credit-card-size, dedicated computer that performs all personal financial transactions.

Looking Ahead

This Card—and it can't be far off—will identify you, give you and the bank your personal audit trial, balance your checkbook when you plug it into a phone line, buy food, clothing and houses for you. It will pay your rent and your utility bills. You will no longer have any need at all for cash—ever.

To the individual, society and even government, this scheme has benefits aplenty.

First, let's take the individual. At the most basic level, you won't have to worry about recording checks. The Card records all transactions automatically. You won't have to worry about your money being lost in the mail or misapplied accidentally by the bank. Furthermore, because the bank can't take advantage of your money through "float" (the Card does everything in real time), you have more control over that money.

Suppose you want to buy a new car at night, but the machine shows your account doesn't have the money for a down payment. If the Card—which holds your full credit history—shows that you are a good credit risk, you can borrow money from an on-line loan company.

Futhermore, you can't be robbed. Once the Card has been reported stolen, its power to perform transactions will simply be de-programmed, making it useless to any thief.

Society as a whole will gain as well. Most muggers and thieves will be put out of business because there won't be any cash left to steal. Bad checks will become a thing of the past. For example, you can't use the Card to buy groceries without having the money in your account; the computer simply won't accept the transaction. In some cases the computer will require voice identification—as well as voice verification—to complete a transaction.

The man who gets drunk and beats up his wife repeatedly, for example, could be denied the use of his Card to buy liquor.

The Punishment Fits the Crime

The nature of punishment for non-violent crimes will change dramatically. Today we hear horror stories of overcrowded prisons that are impossibly costly to maintain. Why incarcerate the non-violent criminal at all when we can program his Card to, say, keep him from using public transportation or from spending any money more than 10 miles from home, or simply from spending more than a certain amount in total—no matter how much he earns? After four speeding tickets, for example, the offender's Card would be remotely programmed to deny him the privilege of buying gasoline. (The same technique could be used to foil the thief who runs off with a car after making only the down payment.)

Even non-violent crimes, such as those tied to drinking, could be dealt with this way. The man who gets drunk and beats up his wife repeatedly, for example, could be denied the use of his Card to buy liquor.

This system would be a boon to the Federal government too. The illegal "underground economy" of cash-only deals will disappear when individuals can no longer stash money in a safe deposit box and avoid declaring it as income. I have a record collection, and I buy records from a dealer who charges me sales tax; I *know* he doesn't pass that sales tax on to the government. In a cashless society this could not happen. Furthermore, when all income taxes are automatically deducted from an individual's account, we will have eliminated both the crime of tax evasion and the expensive process of prosecuting tax evaders.

Logical Conclusions

But wait. Collecting taxes via computer is only the first step—a seemingly harmless procedure as well as a cost-efficient one. But now the government—or one branch of it, the Internal Revenue Service—has complete control of the one and only tool it can use to oppress absolutely everybody: money.

What happens next? Suppose the government decides to eliminate welfare "abuses" by preventing welfare recipients from buying whisky or potato chips—anything but necessities?

As almost all of us routinely use credit cards to make purchases, we have already made a radical departure from our traditional cash-oriented society.

Suppose the system is used to regulate the amount of candy that teenagers with pimples can buy? To prevent overweight people from buying high calorie foods? Or to keep anyone at all from buying marijuana?

At this point the computer will have become a device more insidious than anything ever dreamed of by George Orwell. Technology will have

become a tool used to control social laws, to ensure what society has decided is "correct" social behavior.

The only criminals in this society will be the people we know as computer hackers—those who know how to get around the computer, to make the computer serve society's rebels.

These criminals will have to be far more inventive than their counterparts of the past. For the society pictured here will not deal gently with them.

There are those in our society who would embrace this environment—not bad or unworthy people, but those who prefer order and predictability to risk and adventure. They would choose the kind of control described above to even the smallest possibility of getting mugged on the way to the grocery store.

But the rest of us will fight to keep this prospect from becoming reality. After all, Orwell's 1984 did not come true; and it, like the scenario portrayed here, is merely a natural (though extreme) extension of current trends, not a wild fantasy without basis in fact.

Perhaps the realization of Orwell's predictions was prevented by the very fact that someone did foresee the extreme possibilities. If so, such foresight will serve us well again as we move toward the future. ■

THE INTELLIGENT GAMER/ DAVID LEVY

David Levy was born in London in 1945 and educated at St. Andrews University, Scotland. He won the Scottish Chess Championship in 1968; the following year he was awarded the title of International Master by the International Chess Federation.

Levy has written more than 30 books, most on chess or computer chess. He made a bet in 1968 that no computer program would win a match against him within ten years; he won the bet, but one of his opponents welched. He is currently chairman of Intelligent Software Ltd., a London-based company specializing in the programming of strategy games, particularly chess.

The decade 1974-84 was notable for a number of giant leaps in the field of Artificial Intelligence, not the least of which has been in computerized game playing. It has long been recognized that writing a program to outthink a strong human player at a skillful game, such as chess, would take mankind further along the road towards producing a totally artificial intellect.

The very idea of a genuinely "intelligent" computer program conjures up disbelief in many minds, yet those same minds would not dispute the fact that human chess masters are intelligent. It must surely follow that a program that outperforms a human at an activity requiring intelligence is itself exhibiting intelligence. This philosophical argument is one of many reasons that there has been considerable interest during the past decade in the programming of "intelligent" games.

Amongst the games which require intelligence to play and which have been successfully programmed on computers, I shall single out three: backgammon, reversi (also known as Othello), and chess. I feel that these three games provide a representative spread between tasks which require far more subtle methods and heuristics.

Backgammon

Backgammon is not a game of pure skill. The player decides which men to move, but his decisions are constrained by the roll of the dice. Expert backgammon players play largely "with the odds," which means that they usually know which particular play is most likely to work out best over a very large number of games. Armed with this type of knowledge and/or intuition, a strong backgammon player will normally fleece a weaker player over a long playing session, even though the dice may present a large element of luck in any one game.

There has been considerable research into the mathematics of backgammon, including various studies into the optimal uses of the doubling cube, and the results of this research have been tabulated. A good backgammon program must possess the result of this tabulated information, as well as a sophisticated evaluation function for dealings with less specific situations.

Dr. Hans Berliner, working in the Computer Science Department at Carnegie Mellon University, is not only a former world champion at Correspondence Chess, he is also the author of the world's strongest backgammon program. In July 1979, Berliner's program, BKG 9.8, beat the reigning World Champion, Luigi Villa of Italy, in a $5000 winner-take-all match in Monte Carlo. The score in the match was an amazing seven games to one.

Berliner admits that the program was luckier than Villa when rolling the dice, but even so, such a score against a world champion cannot be attributed entirely to good luck. This was the first time in history that a computer program had won against a human world champion in a game in which good play requires intelligence. Berliner's program clearly exhibits some intelligence in the way it plays, although this is limited by the fact that many of the decisions made by it are based on nothing more than a table lookup.

Reversi

The game of reversi (also known as Othello) is, on the other hand, a game of pure skill, though it lags far behind chess as an intellectual challenge. It was improved in late 19th century England, but did not become popular until around 1970 when it was renamed Othello by a Japanese gentleman, who has since made a small fortune from licensing the rights to the game.

The rules of reversi are simple enough to be learned by a child in less than two minutes, yet the game is sufficiently deep and complex in nature to be on a par with checkers. Suffice it to say that one cannot play reversi by looking up the right move in a table.

TOWARD THE FUTURE

The game requires most of the attributes of a strong chess player, including analytical skill and intuition.

Reversi is an ideal game to program because of the simplicity of its rules, and many computer enthusiasts have written reversi programs, some of which play rather well. Since 1981 they have even been winning games from time to time against the world's strongest human players. The first time this happened was during a man vs. machine Othello tournament held at Northwestern University on June 19, 1981.

> *Reversi is an ideal game to program because of the simplicity of its rules.*

On that day a program called The Moor, written in my company in London, won a tournament game against the reigning World Champion, Hiroshi Inoue of Japan. This was the first time a reigning human world champion had lost to a computer program in a game of pure skill, and subsequently The Moor thrashed the 1981 British Champion, Neil Cosel, by the amazing score of 61 to 2, which is about as easy as my winning Bobby Fischer's queen in a chess game.

Chess

Chess and Go are the most profound of all games of skill, and it has long been one of the fundamental aims of A.I. researchers to produce a chess program that can play as well as a world champion. During the past decade there has been a notable improvement in the standard of the best chess programs, but they are still not yet near world championship caliber.

In 1974, at the time of the first World Computer Chess Championships in Stockholm, the strongest programs were Chess 4.0, written at Northwestern University, and Kaissa from the U.S.S.R. Both of these programs played at just above the 1600 level on the U.S. Chess Federation rating scale (Masters are rated 2200 and above; most Grandmasters are 2500 or above; Bobby Fischer was 2780 when he retired).

Four years later, in August 1978, I successfully defended a bet I had made in 1968, in which I had asserted that

no computer program would win a match against me within ten years. My opponent in the key match was the latest version of the Northwestern program, Chess 4.7, with a playing strength of around 1850.

Now, in 1984, we have a computer program with a Master rating. Ken Thompson's chess machine Belle, which was designed at the Bell Telephone Labs in Murray Hill, NJ, became the first program to attain the rank of U.S. Master when it achieved a 2203 rating in September 1983. From the standpoint of the professional chess player this is still a far cry from the likes of Bobby Fischer, but it is strong enough that the man in the street would not be able to tell the difference. Both Belle and the current World Computer Champion, Cray Blitz, have beaten players rated over 2300 in tournament games. Furthermore, in blitz chess, where each player moves so quickly that tactical oversights are common, the best computer programs have defeated International Masters and Grandmasters on a number of occasions. Chess 4.7 once defeated Robert Hubner of West Germany in a blitz game at a time when Hubner was one of the world's top 10 ranked players. If they can already perform at that level in blitz games, it can be only a matter of time before the strongest chess programs are vying with human world champions under tournament conditions.

The Future

What about the future? I shall stick my neck out and predict that by the time of *Creative Computing's* 20th anniversary issue, the following events will have taken place:

- A computer program will have won a tournament chess game against a Grandmaster.
- A program will have the ability to play Bridge as well as a strong club player.
- No program will be able to play Go at anything above beginner level.
- Fewer than 1% of personal computer owners, when playing their favorite game of skill, will be able to beat the strongest micro-based computer programs. ■

THE MAKING OF A COMPUTER ARTIST/
SAUL BERNSTEIN

We artists are a strange lot. We are insecure people who use art as an entree to society. If we attain any notoriety at all, we are reluctant to give it up. We seldom know whether it is our intellect or our ability to manipulate paint that makes us successful. We have a tendency to be suspicious of anything new—like the computer, which does not allow color to drip or blend or build up. When we look at the famous artists of the past, however, we see that just the opposite is true of them; they embraced the new and the different.

We look at an art book and assume that bronze sculpture and oil painting have always been there. The truth is that there was a time in man's development when oil painting did not exist, when there was no such thing as bronze sculpture. For an artist to es-

chew the computer is to behave in a manner that would have been alien to the likes of Rembrandt, Da Vinci, Goya, and El Greco. If history tells us anything it is that great men have committed themselves again and again to the new and the different.

Communicating with the Collector

History also offers us a handy way to evaluate the ways in which today's art is communicated to today's collector. In the past, the church and the royal families had custody of works of art old and new. Later, as these institutions suffered from diminished power and resources, museums were established.

After a while, the museum establishment grew corrupt. Contemporary artists who, for whatever reason, failed to win the favor of museum curators could not have their works displayed. This led to the creation of the first art gallery about 100 years ago. Today, therefore, we are left with two kinds of institutions, both of which allow people to view works of art and both of which force people to go out of their way to do so.

Today, too, we have satellites orbiting the earth, transmitting signals to cable companies throughout the land. The average American family has two television sets in use six hours a day. That means that for 18 hours a day those TVs sit unused. Our satellites have the ability to transmit 24 channels each, and yet, out of 384 possible channels, only 122 are currently in use. I can see the day that every home will have a computer tied to at least one TV set and be able to receive over those unused channels contemporary art that will become the user's personal collection.

This would be a far better situation than we have today, for after an hour's ride into the city to visit a gallery or museum, all the viewer has to show for his trouble when he gets home is a catalogue of the show. Comparing that to the experience of having every dot in memory is like comparing a reproduction in a book to an original oil painting.

The natural art for television is not oil painting or bronze sculpture; it is the art of the computer. The computer and the television are natural partners: they are both electronic, and they both transmit color in the same way—with pixels. The computer is also a natural vehicle for the artist, for it allows him to control every dot on the screen.

The Making of a Computer Artist

I am frequently asked how a person can prepare himself to produce art on the computer. I start by recommending that he take school work seriously, for that is the ground upon which all skill is built. If a person can communicate with the written word—or even via mathematics or science—he can feel assured that he is on his way to achieving the true interaction that is a prerequisite of art.

Second, I urge him to read about great people, for in this way he can choose role models. Young people need a familiarity with greatness to spur them to higher levels of performance. Familiarity with the traits of great people also helps the young person to learn what to look for in people of his own generation.

Third, I encourage aspiring young artists to study art in the traditional way so they understand fully the anatomy of drawing, color, and composition. A student who is well grounded in the study of anatomy can understand the function of almost anything and, therefore, need not be afraid of anything new. Without this background, the computer artist may end up producing clever images devoid of meaning.

I also believe that the young person should be given a computer so that he can learn the potential of what I call "image reassembly." Using this technique, the user puts the information into the computer in accord with his normal way of seeing. Then he asks the computer to work its magic. The effects are fantastic; the computer displays a multitude of possibilities that no human being could think of. It is a wonderful learning experience that should not be missed by even the most experienced artisan. It clearly shows the limitations of the human brain. It allows the artist to exercise the most important part of his body—his brain. ■

COMPUTER TECHNOLOGY: GREATEST IMPACT ON AMERICA SINCE THE INDUSTRIAL REVOLUTION/ STAN GOLDBERG

Fascinated with the home computer he bought for his family in 1979, Stanley Goldberg turned a family room hobby into a multi-million dollar business in just four years. Goldberg's company, MicroLab, is one of few software companies to combine design, manufacturing, marketing, and distribution within a single business. MicroLab labels each product with a toll-free customer service phone number, a concept rooted in Goldberg's experience as a computer novice when software information was scarcer than the software.

Goldberg, who grew up in Brooklyn, NY, was a marketing vice president for seven years for a New York dress

manufacturer, and this background shows up twice a year when MicroLab's products are introduced to the marketplace as fall and spring lines. His wife, Susan, serves as marketing vice president; his daughter Alicia, 17, has been involved in sales and distribution; and his son Keith, 14, who named the company, has helped to develop several games, and has the official title, Game Consultant.

We are moving from the era of the industrial revolution into a wholly new and different time that will be called "the technological revolution." This is solidly represented by the dazzling array of goods, services, jobs, and other economic factors of computer technology. As a result, we are at once reminded of the past, present, and future of this nation's people.

The industrial revolution touched virtually every segment of our society—rich and poor, male and female, captains of industry and workers alike. If there is anything to be learned from history, we must learn the lessons of change that come with changing technology and its impact on such a broad and diverse number of people, places, and things. Those of us in the computer industry will, hopefully, look at where we have been even as we look where we are going. We must not again ignore the lessons of history.

If there is anything to be learned from history, we must learn the lessons of change that come with changing technology and its impact on such a broad and diverse number of people, places, and things.

We have a dramatic path before us between now and 2000. By 1990, for instance, there will be 30 million jobs that are computer related. And our world is rapidly heading for a cashless, checkless society.

The very real, very immediate future holds changes that are hard to imagine for all but the most dedicated computerphile. And it is the fact of these changes and some of the technology induced effects that will impact the uninitiated and uneducated the hardest that must receive our immediate attention.

Our society doesn't make guarantees. The American dream says that everyone should have the opportunity to succeed. One's place in that dream is largely determined by economics, lifestyle, education, and so forth. Therein lie the differences. If we are to keep the American dream alive, one of the highest priorities we must quickly address is the potential problem of computer illiteracy. We could see an entire class of "new disadvantaged" through such illiteracy.

Computer Literacy

Computers will have a permanent and enduring effect on our country and her people. This impact will be most profound on the poor. This new computer society can be good or it can be bad. The outcome of the revolution will be enforced with economics, and economics will be largely controlled by the computer.

One of the main things that we in the industry must address is the establishment of national standards of computer literacy. The computer illiterate faces a future as bleak as the futures of those who cannot read or write.

In 12,000 higher economic school districts recently surveyed, 76% had computers. This is, sadly, not the percentage found across the board. It is my firm belief and commitment that we in the private sector must take up the standard and help bridge the gap.

In the software industry we have a unique opportunity to reach the nation's youth as never before. The computer is a vehicle which can be used to excite the learner, motivate him, and direct him toward new, positive experiences.

Here at MicroLab we have

achieved a certain degree of financial success. Now is the time for us to pay back the society that has given us so much.

The Inner City

We have an on-going pilot program with the Chicago Public School System to bus youngsters from the inner city to our offices for a six-month program of advanced computer training. We have found motivated high school students and have shared our knowledge with them. Five people on our staff are working part-time with this project.

> *As concerned citizens, we should try to see that our communities understand the challenge ahead and see that our schools and educators are on the same wavelength.*

When this pilot program matures, it is our hope that other companies and school districts will take up the cause and help keep it moving forward. This is something that all of us in our industry could do to help the communities in which we live.

We started with high school age kids. We started with kids from the inner city. If these young people are not exposed to successful role models, if they have no far horizons calling, they will keep the status quo. We must not allow that to happen.

We must give them those "far horizons" to look at; how can they strive if they don't know what is available?

It is this type of cooperation between the public and private sectors that will help shape the direction of our country and its growth. We are changing from an industrial to an intellectual society.

Planning Ahead

Retraining is one of the highest costs that our industries face over the next quarter of a century. If we train in the schools now, we will reduce the cost of retraining later, both in time and dollars.

As concerned citizens, we should

try to see that our communities understand the challenge ahead and see that our schools and educators are on the same wavelength.

While transition offers challenge, it also offers a marvelous opportunity to restructure our companies along more efficient lines, compatible with the information revolution. It is important for us to position ourselves as effective users of the information machines: to develop information and not just program on them. We must teach all of our citizens to be part of this process as the computer becomes the basic resource of our society.

The Role of Women

Within this education process, a different problem is also evolving, and that relates to our work force. Women are our most underdeveloped resource. Of today's computer users 95% are men. We must take steps now to include women in the process as full and equal partners.

This industry is in its ascendancy today; tomorrow it will be the main game in town. This industry must include women in the planning and execution of these long-range efforts. Ten years ago, 50% of families included women who were working outside the home. Today, that figure has jumped to 70%. We must take steps to

This industry is in its ascendancy today; tomorrow it will be the main game in town.

see that women share in the fruits of the computer revolution.

When this country faced its last major revolution, the industrial revolution, the mood of the times placed women in secondary economic positions, and, as that revolution developed, in secondary economic roles. With this new revolution it is time to see that our citizens, both male and female, both rich and poor, are given an equal opportunity to succeed economically in our society. We must strive to see that computer education is not just for the advantaged and is not just for the male. The course of the next hundred years is being charted now, and I hope that all of us have the vision to help shape the society that will truly deliver on the American dream.

Today it is easy for us to see that computer technology will be firmly entrenched in our future. Ten years ago, when David Ahl started *Creative Computing*, few, if any, of us had that vision. But David did, and for his foresight, we are all grateful. For myself, for all of us at MicroLab, I would like to extend congratulations and best wishes to David Ahl and the staff of *Creative Computing* on this achievement. We are all the richer for having the benefit of their faith and dedication to this industry. ■

APPLE COMPUTER: AN INTERVIEW WITH STEVE WOZNIAK

At the extravagant unveiling of Apple's IIc computer last April, the legend of Apple's humble beginnings was documented in a special historical exhibit. Vintage photographs of two young, blue-jeaned, bearded, and shaggy haired computer freaks surrounded other memorabilia, including the wood-cased Apple I computer, a forerunner of the personal computing revolution.

Among the documents on display was a sheet from a yellow pad bearing columns of strange numbers and letters. A sign in the display revealed its meaning. It was part of the compilation of the Apple computer's first ROM software, a compilation which had to be done by hand, since the two inventors had to sell even their calculators to buy parts for their prototype. The scribblings were those of Apple's then-and-now star hacker, Steve Wozniak.

Woz, as he is known to his friends, colleagues, and many thousands of Apple computer fanciers, recounts the contribution he has made to what personal computing is today, "If you look back at the first Apple II, it had about ten features that had never been done in a low cost computer. We built in many things that had never been built-in before. Almost every one of those things—graphics, text, large ROMs including languages like Basic, plastic cases, speakers, paddles, color—have been built into computers since then."

He is careful to distinguish his

early role from that of his co-founder, Steven Jobs. "I knew what computer I wanted to use, but all I needed was a video display and a keyboard. I didn't care what it looked like beyond that. Steve had ideas about products and how we were going to sell computers to the masses someday."

Today at Apple, Woz carries the title of Fellow, a position which should allow him the luxury of pursuing virtually any area of research that he likes. For the moment, however, he finds himself devoting much of his time to to some serious brainstorming. "I have about six pet projects in my head; some that are getting close to going into action. Most of them are software, but the ones I'll do best on are hardware."

Although Steve comes across as self-assured, and indeed knowledgeable about personal computing, he continues to learn a great deal about what is needed for the future by listening closely to the user community, frequently getting personally involved.

"In the last year, I've given computers to about a dozen friends. I helped them set up their computers, taught them, and got them to the point where they could start running useful programs."

Were it not for the neon sculpture of his "Woz" signature, you'd think it could be any Apple employee's workspace.

Apple-related activities outside of the company. Speaking engagements at press and user group functions frequently take him far from his simple office cubicle in one of Apple's Cupertino, CA facilities.

Woz's office is no larger than that of any veteran Apple engineer. Tucked away in a corner of a maze of Herman Miller-styled office dividers, his area is unremarkable. There is no door into a private sanctuary, no nameplate indicating the hallowed ground most outsiders would expect to see. Were it not for the neon sculpture of his "Woz" signature, you'd think it could be any Apple employee's workspace. An Apple IIe, a Macintosh, and one printer are the only signs of Apple activity here. A few color photographs are stuck prominently to his bulletin board—he and his young son, he and his wife, and a picture of Valerie Bertinelli someone took onstage during one of his Us Festivals. On those rare days when he is in his office, you are likely to find him in jeans, looking like just another Apple engineer.

You get the feeling that Steve likes to stay in the background at Apple. He relates that when he came back to Apple from his recent hiatus (during which he completed his formal education in computer science at the University of California—Berkeley), there was pressure put on him to jump into the Apple IIc project, which was a priority at the time. "I tried to avoid it and remain anonymous," he says.

Despite all the distractions, Woz claims that he is ready to settle down

He believes, therefore, that Apple's current direction in recent hardware introductions is just right for non-technical users who are approaching personal computing for the first time. "The IIc and Macintosh are prebuilt. You don't have to worry about plugging anything in. It's like a hi-fi. All you do is plug in a few connectors on the back. That's worth a lot. People who are not around computers and are not technical people cannot be expected to keep track of slots, cards, ways to address them, and special syntax names. They want a fully assembled machine."

The mouse pointing device, a controversial tool, looms large in Woz's beliefs about the immediate future of computer hardware. "Whenever I have the choice of using the mouse or the keyboard, I always go for the mouse. The only thing I find negative about a mouse is that it requires a bit of desk space—but not much."

While Steve may claim to be more comfortable working on hardware, it seems that software has been receiving a great deal of attention in the back of his creative mind. For the near term, software integration appears to have caught his fancy. He notes that as with hardware, "you want your software fully assembled. You don't want each program to work independently and force you to learn all the tricks of an operating system so you can pull something out of a certain disk, convert that file, and store it over on another disk, and then read it into another program. You really want to just grab the data and move it easily.

"You shouldn't have to do in your head what a computer can do. You shouldn't have to think. You should not have to remember." And that's the direction of all computers today. Macintosh is the leading example. It's the only computer my mother would use."

Further into the future of software, Woz perceives a need for new languages and operating systems that let the non-technical user define what the computer should be doing without having to become a highly skilled programmer. He bemoans that to his way of thinking, there has not been a single, really new computer language that wasn't in existence ten years before personal computers became popular.

"The end user ought to be able to program a spreadsheet very easily in a high level language just by saying, 'Divide the screen up into a bunch of cells of a certain size. Allocate a certain program to each cell.' Many of the good things we learned about Forth, Basic, and Pascal can be retained, and many of the bad things can be gotten rid of."

Looking into his crystal ball, Woz foresees personal computers regularly employing some of the technologies that are already working their way down into popular price ranges.

Looking into his crystal ball, Woz foresees personal computers regularly employing some of the technologies that are already working their way down into popular price ranges. Very low cost built-in hard disks, he says, will become commonplace. Larger scale integration will also continually produce more functionality and memory on fewer chips. He does not, however, have much faith in bubble memory technology.

He is particularly excited about the prospects of liquid crystal displays. "LCD displays can finally do graphics—that's just happening this year. There are many unique approaches being proposed by research physicists for things like color LCDs and other display technologies. That's the only technology that will make a huge change in computers in the next five years."

Woz also forecasts that in five years the typical personal computer will be "small, carryable, battery operated, including a display." He believes that display resolution will be either similar to today's range of 500 x 200 pixels or perhaps slightly better. A color LCD display is likely. A megabyte of RAM will be standard "just because a megabyte of RAM costs as little as any other amount of RAM." A disk drive will be built in—perhaps not a hard disk yet, but he is confident that the 3 1/2" disk will replace the 5 1/4" floppy disk as the prevailing removable medium.

As for the personal computer ten years from now, Steve shakes his head, saying, "I can't guess. Unforeseen technologies. Ten years from now, it could be that the printing technology is something totally new that we don't even know yet. It could come out of the research labs at places like Bell Labs, IBM, Hewlett-Packard—maybe it will be an Apple Labs by then."

Who will be the garage-to-giant Apple Computer of tomorrow, and where will such an opportunity come from? "It happens once a decade that a market grows unexpectedly from zero to huge in a very short period of time. Professional companies like IBM knew only what a complete computer system involved. They couldn't see that it was time to start up with new people, new socialization, new magazines, new ways of thinking about newer technologies. They didn't see it was time to get in with some hobby kits and let the user set some new standards.

"I think that even the microcomputer industry has gotten that way now. There could be other groups that start going off in a different direction, a different type of operating system, and they'll have their own magazines.

"And," Woz acknowledges, "we won't expect them."

According to Woz . . . Software Protection and Piracy

"I believe software protection is needed right now. Still, the economic effects of piracy are highly overrated by software producers who are doing marginal business. They talk numbers like $4 billion worth of theft. It turns out theft is more on the order of one percent of that number.

"The casual pirate collects maybe a thousand programs a year. I know a lot of them. There is no way in the world you can use more than about three or five, if you really do use them. Many casual pirates are ethical enough to buy a good copy and a good manual if they do use it. They might steal $10,000 worth of software in a year,

but if they had to buy it, do you think they would come up with $10,000? Maybe $200. That's all they have in their pockets.

"Pirating—stealing—software is wrong. But then again, haven't you ever taken a shortcut through an orchard? That's 'trespassing.' Piracy is 'stealing.' Let's call it what it is. There are levels of rightness and wrongness.

"The young kid hackers who are out there having fun and trying to build a collection are not really evil people. They are not trying to rip off and decide for the rest of their lives that they're going to get things for free. They are not really criminals."

The Impact of "War Games"

"First of all, the movie was an incredibly accurate representation of the computer hacker's mentality. It was exactly the thing I was doing: always exploring and trying to do a little more than you're supposed to be able to.

"When the movie came out, there was a time of about one to two months when all over the country you were reading articles about the 414s. The two images that came out to the public were: 1) computers are unsafe for storing valuables, and 2) hackers are a threat to valuables stored on computers. Both of those myths are very unreal, and they were exaggerated by talk about how those 414 cases *could* have been damaging.

"Hackers cannot get access to information they are locked out of. They cannot, by being intelligent, crack the codes.

"Computers are very safe places for storing valuables, including vital information. We used to store our information in vaults, which are more susceptible to theft than computers are. For example, grades are stored on computers. Occasionally, a hacker will get in and change his grade to an A. I have no doubt in my mind that it happens. The hacker who changed his grades on the school computer either probably knew the password because he had a friend who had a job at the school who knew the password. When grades were stored in drawers, there was always a kid in the school who had access to the grade records and changed them occasionally. That sort of thing isn't increased because of computers. Computers didn't cause it." ■

> *"You shouldn't have to do in your head what a computer can do. You shouldn't have to think. You should not have to remember."*

TANDY RADIO SHACK ENTERS THE MAGIC WORLD OF COMPUTERS

Ever since Charles Tandy's original acquisition of nine ailing Radio Shack stores in 1963, Tandy Corporation has grown like Topsy, with the 35% annual earnings growth of the computer division setting the pace for the past five years. While generally profitable, this corporate growth has not been without pain—again, with the computer division contributing more than its fair share.

Until recently, Tandy was a very tightmouthed company. Writers were welcome in Fort Worth as long as they printed the company line. But if a publication said anything the least bit critical, it found itself on the black list.

Recently, however, Tandy's growth has slowed; its share of the computer market has slipped; and its stock price has plummeted to $29 compared to $64 in mid-1983. Realizing that Tandy's image has lost some of its glitter, Chairman John Roach recently appointed Ed Juge director of market planning with part of his mission being to set up a formal public relations department, something the company has never had before. Thus the door is being opened to outsiders—at least a crack—and the outside world can finally catch a glimpse behind the scenes.

Despite some current problems, Tandy has made one of the most significant contributions to the small computer field and plans to be a major player in the business in the years to come. How did they get where they are today?

Death of CB; Birth of Computers

Remember the CB craze? Tandy certainly does. From nothing in 1970 to over 20% of the corporate business in the early 70's, CB radios not only contributed to profits, but brought an entire new group of customers into Radio Shack stores. Indeed, things were so good in electronics that Tandy Corp. sold off all its other subsidiaries including the original Tandy Leather in 1975.

But the abrupt collapse of the CB craze in 1977 left the company in disarray. Enter Don French and John Roach. Roach had joined Tandy in 1967 as a data processing manager and, by 1976, had been promoted to vice president of manufacturing. Don French was a buyer on the West Coast in the heart of Silicon Valley. He had bought an Altair and had been trying to get Radio Shack involved in computers, even though his boss, Bernie Appel (recently promoted to president) was opposed. Despite this, French had even gone so far as to devise a design for a computer on his own time.

In mid-76, Roach and French were traveling together on the West Coast and stopped in to see National Semiconductor's new SC/MP microprocessor. While there, they met Steve Leininger who briefed them on the hardware and software.

Roach and French were impressed with Leininger and wanted to hire him to do some consulting. However, the National Semi marketing people refused to part with Leininger's address or phone.

Next stop on the itinerary of Roach and French was Paul Terrell's Byte Shop on El Camino Real. Imagine their surprise to find Leininger moonlighting there as the night sales clerk. They talked to him about consulting, and four weeks later asked him to come down to Ft. Worth to see the facilities. At the end of the day, Roach offered him a job.

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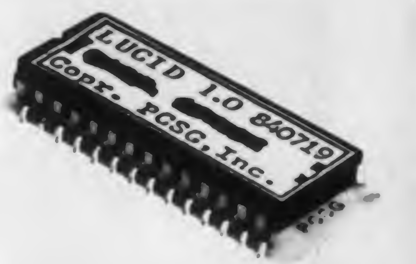

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CIRCLE 190 ON READER SERVICE CARD

Leininger accepted but found that Tandy wasn't really committed to a computer just yet. For six months he, in his words, "played around with a couple of things—an audio pre-amp, a computer kit, and some other minor projects."

At the end of the demonstration, Tandy confessed that he had already leaked word of the project to the press, and the only question to be decided was how many to build.

But as CB turned sour, there was a growing cry at Tandy for something new. Finally, Leininger was moved off into a room of his own with instructions to build a computer. Leininger remembers it well: "It was there that I wire-wrapped the predecessor of the Model I. I even put Tiny Basic with the graphics extensions in a 2K ROM." (Tiny Basic was written by Dr. Wang at Stanford and placed in the public domain. Leininger had helped implement it for People's Computer company, an open-to-the-public center in Menlo Park.)

The unveiling to Charles Tandy was on February 2, 1977. Leininger put the six wire wrapped boards under a table draped with a curtain. Only the keyboard and monitor were on top, so it resembled the proposed Model I. Leininger remembers feeling a bit discouraged since Tandy seemed rather indifferent and just puffed away on his big cigar. But at the end of the demonstration, Tandy confessed that he had already leaked word of the project to the press, and the only question to be decided was how many to build.

Appel and others were still quite opposed to the project, so the suggested quantities were quite low. Finally, agreement was reached to build 3500 units. Leininger explains, "That's how many stores we had at the time, the thought being that we could use the darned things for inventory or something—one for each store—if we couldn't sell them. So I went off to turn the thing into a real product."

Four wire wrap prototypes were built: two for Leininger, one for David Lien, a San Diego-based technical author who had been hired to write the User's Manual, and one for a newly-formed software applications group (initially the "group" consisted of one man, Van Chandler).

Chandler recalls how he got involved with the project. "I had worked for John Roach years before in the data processing center. Then, in February '77, John asked me to come over and look at what this crazy kid Steve Leininger had put together. It was sitting there on a pine board with wires and a keyboard and monitor hanging off the side. John asked if I could make it do something, so I learned Basic practically over night and entered a few programs. He was thoroughly impressed."

Unfortunately, the consultant who had been hired to write the full Basic (he had written a 6800-based Basic for Southwest Technical Products) just up and disappeared. Again, Tandy turned to Leininger—to do Basic as well as finish the hardware design.

Leininger remembers those days well: begging for a 30 cps DECwriter to replace his aging 10 cps Teletype, the disk drives of the development machine crashing on Memorial Day, laying out the boards over and over, and the cassette interface that just wouldn't load. "The next day was 'drop dead' day and Jack Sellers, general manager of Tandy Corp. was in the office with me that night. It was 1:30 and the computer just wouldn't read from the cassette. I had a 'scope on it and everything checked out okay. For the life of me, I just couldn't figure it out. Jack was wringing his hands and saying, 'What are we going to do?'"


John Roach

Leininger continues, "So I finally took the (operating system) listing down the hall with me to the john and sat down with it. While I was there, I found the problem."

Days later, on August 3, 1977, the TRS-80 (for Tandy Radio Shack) was unveiled at the Warwick Hotel in New York City. Leininger recalls, "They were going to show six computers, but we took ten machines just in case. As it turned out, the first six worked flawlessly, and we never needed the backups." From a marketing standpoint, the introduction was somewhat less successful. Roach recalls that the press coverage "was ho-hum since a building someplace else in the city had been bombed the same morning."

Chandler has a cheerier memory of the introduction. "When we got back to Ft. Worth," he recalls, "there were six sacks of mail inquiring about the product. We got on top of the stack of mail and had someone take a picture." (Sorry, we couldn't get a copy for this article.)

On the other hand, there were no mixed feelings about the product rollout; it was eminently successful. Unlike other manufacturers who announced products months before they were ready to ship (Commodore had announced the Pet nearly four months earlier and yet to ship one), Tandy was ready to go by September 1977. Moreover, the company had a chain of stores in place, the name was known (even if it did not suggest computers), and it had good advertising support via the monthly Radio Shack flyer.

The original target price for the computer was $199, then $300. In the final announcement, a stripped machine was pegged at $399—considerably less than competitors were charging for a kit—and the TRS-80 was to come assembled!

It was quickly apparent that 3500 machines was a low guess. Within a month, Tandy had 10,000 orders. By the end of December 1977, 5000 machines had been delivered. But unlike other entrepreneurial companies, Tandy had experience with ramping up to produce high quantities, and by the

spring of '78, they were looking for ways to increase sales still further.

According to Roach, "That spring, we began our version of computer barnstorming. Our first stop was Phoenix. From there, we went around the country, rented hotel rooms, and invited people—the press, financial commmunity, and general public—to see a real personal computer. Our major goals were to build computer awareness and to make sure that the early enthusiasm was sustained. After all, once you have your factory up to producing 18,000 units a month, you've got to make sure you can sell that many."

We went around the country, rented hotel rooms, and invited people—the press, financial community, and general public—to see a real personal computer.

In the summer and fall of 1978, the Tandy barnstormers visited nearly 50 cities throughout the U.S. Then, in '79, the program was repeated on an even grander scale. Much to the amazement of everyone involved, the people who showed up were far more than young techies. "We had curiosity seekers, kids and their parents, electronics hobbyists, senior citizens—a real assortment," said Roach.

Business Users, Too

"Initially, we looked on computers as just another product, mainly something of interest to the electronics enthusiast. But after we'd been selling them for a while," said Roach, "we realized that business users were buying a high percentage of the equipment. We did a survey after we had about 50,000 machines in the field and found there was a big hobbyist and enthusiast market, but a surprisingly large business market as well." Unfortunately, there wasn't much in the way of business software, nor was the Model I itself, particularly the cassette version, especially suitable for business use.

Chandler recalls working on the disk software from November 1977 to March 1978 and "still finding one bug after another. It was so unstable and screwed up that John Roach finally told me, 'go to Albuquerque (home of Microsoft, suppliers of the disk Basic) and don't come back until you have the disk Basic running.' It took three weeks, but we got it done."

The original TRS-80 was a limited machine with 4K of memory, upper case only, a restricted Basic, and cassette storage. Even with the disk system and extended Microsoft Basic, the improvement was not enough to make it a serious contender in the business market. Tandy executives recognized that, and on May 30, 1979, the TRS-80 Model II, a state-of-the-art business machine was announced. It had dual 8" disk drives and might have taken the business market by storm had it not had a nameplate reading "Radio Shack."

The design of the Model II was as farsighted as that of the ubiquitous Apple II. With a few plug-in cards it can become a Model 12, a real small business workhorse, or even a Model 16B, today the best-selling Unix-based system in the world. The 16B even supports three additional users under the specially designed TRS-Xenix version of the Unix III software.

And as long as we are getting ahead of ourselves and talking about today's business products, let us remember that Radio Shack has the best selling notebook computer in the world, the Model 100. Although the Epson HX-20 was introduced more than a year earlier, the Model 100 is the unquestioned sales leader in the notebook computer derby.

Van Chandler (L) of Radio Shack with Linda Harrison at the second Personal Computing Expo in Atlantic City, August 1977.

Distribution: The Key to Profits

According to John Roach, Radio Shack is "basically a distribution system for high technology products." President Appel echoes that view: "We sell to the true middle American. Radio Shack is the local store." This broad based, middle American approach has brought excellent profits to the company. While the product mix has changed from primarily components in the 60's to hi-fi and audio in the 70's to a mixture of computers (35%), hi-fi (18%), parts (13%), and other lines in the 80's, Radio Shack has been consistently profitable. Much of that can be attributed to the widespread chain of stores.

Tandy opened its first computer center (in Fort Worth) almost at the same time it shipped its first computer. Nine months later, in June 1978, Tandy announced it planned to open 50 computer centers around the country. Today, there are nearly 500 full-line Tandy Radio Shack computer centers and 800-900 "plus" computer stores (Radio Shack stores with a large computer section).

On paper, this sounds good, but in reality it means training a large number of people and long lines of communication. Ron G. Stegall, senior vice president for computer marketing, explained that the system is continuing to evolve. On the horizon is a plan to put the computer centers under a newly-formed business product management group. This group will be more tightly structured than the existing organization which is responsible for regular Radio Shack stores as well as computer centers. Under the new separate structure, each of 60 district managers will be responsible for only eight or nine computer centers.

Tandy expects this new structure to result in better sales training. Our own undercover consumers (see June '84, pp. 126-141) certainly confirmed that this is a weak spot. In addition, in the future, computer centers will deal mainly with business (including education) customers, and the regular stores will sell to home consumers. The computers themselves will be changing too; in the future they will become

combined computer/telephone centers and start to handle key systems (2 to 16 lines) and other telephone equipment for small business.

Recalling the success of the barnstorming team in the early days, Tandy is hoping for a repeat performance on a much wider scale. Market research indicated that many families with young children wanted computers, but felt they did not have the knowledge to choose among the systems available. In response, the company started hiring experienced door-to-door salespeople to make presentations to PTA meetings, church groups, and families at home (who requested them). This nationwide sales team is eventually expected to grow to 1000 or more people.

Market research indicated that many families with young children wanted computers, but felt they did not have the knowledge to choose among the systems available.

Product Evolution and Price Erosion

In addition to telephone key systems, other important changes are taking place in the Tandy product line. Of course, there is the usual evolution to offering more products in growing areas and fewer products in contracting areas, but in addition, the company has identified a group of products as the "Advanced Technology Series." Whereas Tandy has normally been a price leader, these products are expected to sell on their technical merits, rather than their low prices. Also, some 600 products in the 1985 catalog are priced higher than they were in the 1984 one — a sharp departure from previous years in which there were few, if any, price increases.

On the other hand, first and foremost, Tandy is interested in producing a return for its investors. While computers are important, "we still sell vacuum tubes," says Roach. Why? Because they are profitable. But he admits that it is becoming more and more difficult to make a profit on computers.

When the great home computer price war of 1982-83 took place, Tandy attempted to stay on the sidelines, making only the price cuts in its Color Computer that were warranted by increased production efficiencies and lower parts costs. Although their market share dropped a point or two, the strategy was a sound one since Tandy's margins remained healthy. And with the demise of TI, Timex, and Mattel, Tandy's share has rebounded to a level higher than it was before the price war began. In an interview in late '83, Roach said that in the long run, TI's withdrawal would be "a positive thing for the market." Time has proved that it was certainly positive for Tandy.

At the upper end, Tandy anticipated modest annual price cuts of 10% to 15%. Thus, they were caught off guard when industry-wide prices started to fall at about twice that rate. In response, this year the company has had to cut the price of the best selling Model 4 to $1099, a whopping 35% cut. They have also been forced to cut the price of the Model 100 by 25%, with the possibility of another cut by year end. Some of the associate stores are already selling the machine for as low as $469, some 41% under last year's price. Even printers and peripherals introduced as recently as the beginning of the year are being discounted in the monthly sales flyers by as much as 40%, cuts that tend to become permanent two or three months later.

First Showing of the TRS-80 Model I, Personal Computing Show, Chicago, September 1977.

Moreover, the company's current woes go beyond pricing. The Model 2000, the company's first IBM compatible, has received excellent reviews but was a late starter. Part of this was due to engineering problems in trying to make it run at four times the speed of the PC, but part was a result of indecision as to whether to produce a PC compatible at all. Future Computing, a market research firm, estimates that the late start will cause Tandy to lose at least one point of market share among higher priced machines.

On the other hand, there seems to be no foot dragging today in product development. A successor for the Model 100, the Model 200, is planned for introduction in early 1985. It will have a larger LCD display, more software in ROM, and possibly a quieter keyboard. John Roach admits to having to speak louder at the company's annual meeting to be heard over the clacking of numerous Model 100s in the audience.

All the 8-bit computers will get a "face lift" according to Van Chandler and, in a radical departure, the company will start to offer peripherals for computers of other manufacturers in 1985. All of Tandy's computers employ an odd printer protocol which requires the printers to insert a linefeed when a carriage return is transmitted. New printers will have a switch to defeat this feature and allow them to work with the computers of other manufacturers.

Roach commented about the Apple campaign, "Apple II Forever," and said Tandy had similar plans for the Color Computer. While he sees the Model 12 declining in popularity in favor of the Model 16 and the Model 2000, he feels the multi-user configuration of the Model 16 more than picks up the slack. He also thinks the Model 2000 "will really come alive when we get a new generation of software."

Roach also admits an admiration for the HP Portable and thinks that "all machines may be basically portable sometime in the near future."

Perhaps most important, Tandy realizes that the Radio Shack name has caused them to lag in the image race. Also contributing to a mundane image is the fact that Radio Shack has tended

to emphasize price in their ads rather than capability and technology. "You'll see a major change in our advertising approach," says Roach. New advertising will emphasize the capabilities for the customer and, perhaps most important, computers will be designated by the Tandy name rather than Radio Shack.

A successor for the Model 100, the Model 200, is planned for introduction in early 1985.

Success in the Education Market

While the company has had mixed success in the home and business markets, it has been eminently successful in education. Why is this? According to Stegall, "We have never looked at it as a hardware business. We've made a more concerned effort in our education division to develop software and help others develop software than any other player in the business. We have more than 100 courseware titles developed internally and perhaps three times as many titles developed outside that we carry."

He further opined, "We have a larger market share than anybody else—even Apple." Although surveys frequently show Apple in first place, he feels those surveys are inaccurate. "We go to individual state surveys that monitor the total number of CPUs and, with the exception of California, these surveys generally show us as number 1. So we're in a very strong position, but the best is yet to come."

What's coming in education? On our visits to Fort Worth we saw an easy-to-use multi-user system and scores of new courseware packages. In addition, the company has introduced a Courseware Preview Library at all of the computer centers. This gives teachers, administrators, and parents the opportunity to test and evaluate all the available software and documentation before making a purchase. With this system, people can make informed buying decisions, something that is often very difficult to do with the software for other computers.

A Communications and Information Revolution

Leaning back in his chair on the 19th floor of Tandy Center, Roach philosophizes, "It is obvious that the microcomputer is at the center of a communications and information revolution. I believe that within 20 years most Americans will be computer users and will benefit from the attendant mental advantage.

"When we see the tremendous impact that mechanical advantage has had on society, the impact of mental advantage on our standard of living and rate of innovation is mind boggling. We are having a great impact on the future. Let us all do it well." ■

IBM: COLOSSUS OF ARMONK

Staid, conservative, Eastern IBM: a corporation where executives could wear any shade of white shirt they chose, where new employees were taught songs of company loyalty, where unquestioned success had been built upon a platform of room-sized, climate-controlled, multimillion-dollar mainframe computers.

Just as the personal computer business had finally begun to take off at the start of the 1980s, following a trail blazed by companies like IMSAI, MITS, Cromemco, garage-born Apple, and hobbyist-based Radio Shack, the rumor began to float about that the Colossus of Armonk was going to enter the marketplace. "That will be," said one wise industry observer, "like teaching an elephant to tap dance."

Well, the Big Blue pachyderm turned out to be a natural at the two-step, the waltz, and the mambo. It now calls the tune for the entire industry. Its products—the IBM PC, PC-XT, PCjr, and the new PC AT—are considered the standard against which would-be participants in the personal computer marketplace are judged. (You don't ask whether a new machine is fast or slow, new technology or old. The first question is, "Is it PC compatible?")

The story of how IBM came to such prominence would seem to be a combination of careful planning, bureaucratic obstruction, missed opportunities, and perfect timing. All of this was backed, in the last 30 years at least, by the phenomenal financial, research, and marketing resources of one of the world's largest companies. Consider this: last year IBM spent more than $3 billion on research and development around the world. That is three times as much as the total sales grossed by "challenger" Apple in 1983.

Roofs

Though IBM is a "new" company in the microcomputer marketplace, it can trace its corporate roots back to 1890 and Herman Hollerith's introduction of the first punch card reader for data tabulation. Hollerith's device was adopted by the U.S. Census office that year to aid with the head-counting task for our fast growing country of 63 million people.

Meanwhile, Thomas Watson Sr., born in 1874 in upstate New York, had progressed from a job as a travelling piano, organ, and sewing machine salesman in Painted Post, NY, to a position with the National Cash Register Company (now known as NCR). The company was run by John H. Patterson, who called himself "the father of modern salesmanship."

Patterson's theories included an all-stops-pulled, no holds barred approach to selling, and a dedication to fiercely loyal corporate culture. Patterson combined handsome rewards and cold fear of failure as motivators for his "troops"—there was a military-like hierarchy among employees, with rank and promotion ceremonies. He introduced exclusive territories for salesmen, a sales quota system, and internal societies like the Hundred Percent Club for drummers who had met their quotas.

Within three years of joining NCR, Watson had become the star salesman in upstate New York and was promoted to a managerial position. In 1912, Patterson, Watson and 30 other NCR employees were indicted by the federal government under the Sherman Antitrust Act, accused of practices including tampering with competitors' machines, buying or bribing salesmen from other companies, and seeking to establish and maintain a monopoly in the cash register business. All of the defendants were found guilty and Patterson and Watson were among those sentenced to pay a $5000 fine

and serve a year in prison. The case was appealed, and later a retrial was ordered. Before a second trial, though, the government offered an out-of-court settlement. Watson, however, refused to sign a consent decree that would have settled the case—he said later that to do so would have admitted guilt. Patterson fired him. He was 40 years old and out of work.

Watson found a job with the Computing-Tabulating-Recording Co. in 1914, as general manager. The company was a bank-forced amalgamation of three firms: Tabulating Machine, International Time, and Computing Scale in upstate New York. It manufactured butcher scales, meat slicers, coffee grinders, punched card readers, Hollerith tabulating machines, and time clocks. In 1917, CTR entered the Canadian market, and the name was changed to the International Business Machines Corporation for part of its operations. The full company would adopt the IBM label in 1924.

Under Watson's steerage, the company was almost immediately successful. During World War I, its scales were used in shipyards and factories. When the war ended, the company's sales had doubled from $4.2 million in 1914 to $8.3 million in 1917, with earnings up from $490,000 to $1.6 million. Hollerith tabulators and sorters became bestsellers among burgeoning government agencies, insurance companies, and railroads in the postwar era.

One other thing Watson brought to IBM was a refinement of Patterson's management and motivation techniques. The emphasis was on empire and sales. Inside the company, hardworking employees were well rewarded for their loyalty; outside, customers paid well for high quality equipment that was backed by unparalleled support. IBM salesmen were often engineers; IBM technicians often spent weeks or months working with customers on planning and installation of major pieces of equipment. And the company was hugely successful, with growth rates between the wars as high as 24% per year.

Early Successes

IBM's history, then, has been built upon the quality of its products and the success of its sales force, and not necessarily on always being the first out with a new technology or process.

For example, IBM was not the first typewriter maker, but its electric models and later its Selectric line all but took over the huge business market when introduced. So, too, with its computer products.

During the years leading up to World War II, government agencies, universities, and private concerns were hard at work attempting to adapt the mechanical tabulating devices of IBM and other companies to become general purpose computers for scientific purposes. The players included IBM, Remington Rand (a firearm manufacturer that had expanded into the office with a line of typewriters), the Burroughs Corp., Watson's old employer NCR, and General Electric. Though IBM spent hundreds of thousands of dollars on development of a large computer in 1940—the Mark I—Thomas Watson Jr., and therefore the company, was unsure about the long term use for the device, and thought them unlikely to replace calculators and adding machines in offices.

In 1950, Remington Rand vaulted to the top of the infant computer business when it introduced the UNIVAC, an offspring of ENIAC (Electric Numeric Integrator and Calculator), developed by physicist John Mauchly and electrical engineer J. Presper Eckert, at the University of Pennsylvania. The first UNIVACs displaced IBM tabulators at the Census Bureau—the place where Herman Hollerith had started the company that lead to IBM. IBM had to wait until 1952 before it could come out with its own model. That device was not as advanced as Remington Rand's machine, but once again IBM was on the move. Within five years, the company's 704 and 705 series computers were the leaders in the industry, and IBM was on top with an 85% share of the infant market.

The first machines were bulky, and their vacuum tubes generated a great deal of heat. IBM's customer service tradition kept it a favorite among corporate clients, even as the competition became more and more intense. IBM was the leader, followed by what quickly became known as the Seven Dwarfs: the merged Sperry-Rand Corp., Control Data, Honeywell, Burroughs, NCR, RCA, and General Electric.

It was in the late sixties and into the seventies, though, that IBM began to lose some of its luster as the result of a pair of occurrences: first, the U.S. Justice Department began investigating and later filed suit against IBM for antitrust violations, centering upon allegations that the company's practice of cradle-to-grave "bundling" of engineering, sales, installation, software design, and maintenance was anticompetitive; second, IBM somehow managed to completely miss the fast growing "minicomputer" market. Upstarts like Digital Equipment Corp. (DEC) and Data General began to carve away at some of IBM's base by selling smaller computers for specific purposes.

Perhaps, some have said, it was the antitrust suit that distracted IBM's attention—the case dragged on for 13 years before it was finally dropped in 1982. Perhaps it was the bureaucratic inertia of a company with more than 300,000 employees that kept IBM from

System 370/155 at Princeton University, September 1973. James Page (L), computer center director, Guy Moser (R), executive director of Educational Information Services.

Prior to the PC, IBM attended shows with products such as the 5100 and various word processing machines but rarely generated much traffic. Their booth was practically deserted at the PC Expo in Chicago, October 1980.

reacting. In any case, IBM began to change at the end of the 1970s, primarily through the results of an unusual experiment in internal enterprise zones.

IBM established more than a dozen Independent Business Units that were to function essentially as separate enterpreneurial companies within the corporation. They could draw upon IBM's resources and research and use the clout of the IBM name without having to work through the multi-layered bureaucratic structure of the parent company.

In a key element of the success of the IBM PC, Microsoft retained marketing rights to a version of the operating system it was selling to IBM.

The Micro Mandate

In the summer of 1980, Philip "Don" Estridge, an IBM divisional vice president, was told to investigate a possible entrance into the microcomputer market. He and a team of 12 worked for the next year on a machine that would make the elephant tap dance.

The Entry Systems Group in Boca Raton, FL, had to make several important decisions:

What kind of design would the machine use? Should it represent the state of the art in technology or should IBM instead "legitimize" the market with a refinement of existing designs?

Would they follow IBM tradition and come out with a machine heavily based upon company-patented hardware and software, thereby locking most competitors out of the market?

Which operating system would the machine use? Would it be the developing microcomputer leader, CP/M from Digital Research or a different existing system, or would IBM follow its historical form and use a proprietary system over which it could maintain control?

How would the machine be marketed? As a home computer? As a home/small business machine like the Apple and Radio Shack lines? As a big business machine like the rest of the IBM offerings?

Who would sell the machine? IBM had almost no experience with mass market retailing, relying instead upon its corps of professional sales people.

In retrospect, it seems that Estridge's small enterpreneurship made all of the right decisions in its frenzied year. They made some daring changes from IBM's ordinary way of doing business; in other instances they kept very close to the corporation's super-conservative tradition; in still other areas, they hedged their bets.

It is nearly impossible to pin down the exact order in which decisions were made, but the interlinking process produced the IBM PC as we know it now.

Designing the PC

Rather than trying to redefine the microcomputer, IBM would instead rely upon existing, proven technology to produce a competent, well backed, machine. This decision would also help to speed up the design process and allow for a very rapid build-up of production. Along with this path came the decision to purchase as many parts and sub-assemblies of the computer from outside companies as was feasible—again, this saved time, expense, and capital outlay. (Inside IBM's Entry Systems Division, they claim that every manufacturing step is preceded by a "Make or Buy" economic analysis.)

It was also decided along the way that the machine would have an "open" architecture, like that of the Apple family. IBM would include slots under the cover of the machine that could accommodate plug-in boards that would add features or even change the entire personality of the PC. And, to make it relatively easy for outside companies to participate in the building of the PC market, IBM would publish a Technical Reference Manual with the entire set of electrical schematics for the machine and a full explanation and printout of the ROM-based BIOS (Basic Input Output System) that provides the hooks into the machine for hardware and software. The ROM BIOS and the IBM logo were actually the only elements of the entire machine that bore an IBM copyright.

According to the unproven history of the time, IBM was undecided whether to use an 8 or 16-bit microprocessor. Discussions were begun—in typical IBM super-secrecy—with Microsoft's Bill Gates for a package of languages. According to several published accounts, IBM, with Gates' introduction, approached Gary Kildall's Digital Research Corp. to talk about purchasing rights to CP/M, but was rebuffed. DR didn't want to sign IBM's broad nondisclosure agreement and release proprietary secrets without some hint of the nature of IBM's interest. IBM would make no compromise and returned to Microsoft, with whom they eventually signed a contract for a new operating system.

Nearly all of the microcomputers then on the market were using 8-bit processors like the 6502 in the Apple or the Z80 in the CP/M machines. There were, though, proven 16-bit microprocessors available, and these chips could operate at much greater speeds and address much larger blocks of memory. Partly at the prodding of Bill Gates, IBM made a strategic compromise here and chose a hybrid microprocessor from Intel, the 8088. This chip could manipulate 16-bit blocks of information internally, but relied upon an 8-bit external bus for support. (Think of it as a 16-lane tunnel with an 8-lane highway connecting to it at either end.) The resulting machine was faster than the 8-bit competition, but not as fast as a true 16-bit device. However, the 8-bit bus was considerably less expensive to design, build, and fill out with add-on devices; thus, IBM was able to hold the price down.

Microsoft's operating system, dubbed PC-DOS, was an adaptation of SCP-DOS, written by Tim Patterson of Seattle Computer Products for a machine based on a true 16-bit microprocessor, the Intel 8086. In a key element of the success of the IBM PC, Microsoft retained marketing rights to a version of the operating system it was selling to IBM. This version, called MS-DOS, was to provide the engine for the dozens of IBM "clones" that would come along in later years.

IBM apparently was quite uncertain where the PC would find its place. It could see hundreds of thousands of Apple IIs and TRS-80 models in the homes, with only relatively insignificant penetration into the office. The Apple II, in its most minimal

configuration, was available for about $1500; the TRS-80 Model III was at about the same level.

Although it seems hard to believe now, when IBM first introduced the PC in August, 1981, it offered a model with just 16K of RAM on the motherboard and instructions on how to hook the unit up to a standard home audio cassette machine for recording and playback of data. That model was advertised at $1265, or $1565 with a color/graphics video adapter.

The true cost of an IBM PC configured for serious use, rose rapidly from there, but IBM still seemed bound and determined to compete with the price set by Apple. An Apple II Plus with 48K of RAM, a single 143K disk drive, DOS, and necessary third-party hardware modifications to allow it to display 80 characters on a monitor screen sold for about $2800 list. An equivalent IBM PC, with 48K of RAM, a single 160K disk drive, DOS, a color/graphics adapter board, and a game adapter card had a list price of $2630.

Marketing the PC

And then there was the marketing. Though there was at first the sort of conservative, image-conscious advertising campaign you might have expected ("Presenting the IBM of Personal Computers" read the headline on the first series of print ads), the campaign soon began to take off in a new direction, waddling into the American consciousness behind the pigeon-toed walk of Charlie Chaplin. More than two years into the campaign (by New York's Lord Geller Advertising Agency), it is hard to see the Little Tramp without thinking, in a warm cuddly sort of way, of IBM and its personal computer products.

There was another crucial decision made, again at major divergence from IBM's history. The company opened up two additional channels of distribution for its machines: it set up its own chain of IBM Product Centers in major cities to offer officially sanctioned retail sales, and it signed contracts with a carefully chosen group of retail computer stores, including many of the ComputerLand franchisees. IBM also gave the machine over to its internal sales force, and they aggressively entered into the corporate world in search of contracts for dozens of computers at a time—often at corporate discounts of as much as 40%.

We will probably never know exactly how many PCs IBM has sold, since the company does not divulge product shipment numbers; nor does it break down profit and loss by division in a meaningful fashion. However, it is estimated that there are already between one and one-and-a-half million IBM PCs in the hands of users, and that number could grow by several million more just in 1984.

Impact of the PC

Another way to measure the impact of the IBM microcomputer is to look at the growth of the hangers-on, companies that came from nowhere or close to it, to become multimillion dollar operations: Tandon (at first the only supplier of floppy disk drives for

IBM and now one of several large volume suppliers to IBM and compatible manufacturers); Tecmar (from a small specialty hardware company to a major supplier of hardware for IBM, Apple, and other computer manufacturers); AST; Quadram (credited with launching the multi-function board sub-industry for devices to plug into the limited slots of the PC); Lotus Development Corp. (developer and marketer of *Lotus 1-2-3* software); Microsoft (which has gone on to develop, with IBM, later versions of PC-DOS, and other languages, and has sold hundreds of thousands of licenses for MS-DOS to PC-compatible manufacturers.)

And, part of the history can be gauged by the story of *PC* magazine, launched in early 1982 with a slim 96-page bi-monthly effort. By December of 1983, the now-monthly magazine had crossed 800 pages—nearly 500 of them advertisements. *PC* magazine doubled its frequency again in 1984, and each of its bi-weekly issues currently weighs in at about 400 pages.

Another way to measure the impact of the IBM microcomputer is to look at the growth of the hangers-on, companies that came from nowhere or close to it, to become multimillion dollar operations.

And finally, there has been the phenomenon of the PC-compatible computer. There are now dozens of ways to buy a computer that will run some percentage of the programs written for the IBM PC; many of those machines will accept most of the hardware developed for the "real thing." The most spectacular success story appears to be that of Compaq Computer, which went from zero income and no product in 1982 to sales of about $100 million in 1983. That company shrank the size of the PC down to fit into a sewing machine sized box—they called it a portable, but most weary users would admit its 30 pounds or so of weight made it more of a "transportable."

Other companies like Columbia and Corona sought at first to compete with IBM on the basis of price and later on added features. Recently, machines from Eagle, Stearns, Compaq, Radio Shack, and others have taken a step away from a high level of compatibility in favor of going beyond the limits of the 8088 chip and toward what has been dubbed the "turbo" performance of microprocessors like the 8086, the 80186, and the 80286.

IBM itself has paid scant notice to the compatible marketplace, since it has had little trouble selling as many PCs as it could crank out of its factories. It has, though, jealously guarded the copyright on its ROM BIOS, taking a few manufacturers to court when they strayed too close in their emulation.

Along the way to the PC AT, IBM made what has to be considered the biggest misstep of the Entry Systems Division.

Climbing the Sales Curve—Again

Meanwhile, IBM took steps to ensure the sales of its top-line personal computers. Management reverted to one of the company's tried and true operating strategies: It consistently dropped the prices on its PC line as competitors began to come close to affecting demand for available machines. And, just at the moment when it appeared that the IBM PC might be at the top of a bell curve-shaped sales history, it announced a new family of machines that seem destined to be its replacement.

The PC AT is one of IBM's most aggressive marketing moves in many years. Instead of taking the conservative, proven route IBM chose when it introduced the PC, the company has leaped over the heads of its competitors with a line of microcomputers offering advanced technology and features. The PC AT, with its speedy 80286 microprocessor, its 1.2Mb floppy disks, and its available internal 20-megabyte hard disks, is generations ahead of any other major company offering—certainly well ahead of any present or near-to-market offerings from number two Apple.

Along the way to the PC AT, IBM made what has to be considered the biggest misstep of the Entry Systems Division—the mislaunch of the PCjr. But the nature and means of the company's recovery from that error is representative both of IBM's corporate history and its future plans.

According to company sources, IBM began development of a low price, easy-to-use "home computer" based on the IBM PC soon after the larger machine was deemed a likely success. Somewhere along its two-year development path, though, the machine turned into a strange amalgam of a high-powered IBM compatible computer and a series of intentional crippling design elements. The marketers thought was that this machine should go only into the homes and schools of America, and not cannibalize the sales of the PC. The designers thought that their mandate was to find ways to sharply reduce the manufacturing cost of a PC-DOS computer. At the same time, the supposed home computer market turned out to be much more interested in *VisiCalc* than in *Space Invaders*.

The PCjr, with its toy-like Chiclet keyboard, single disk drive, and official top-end memory limit of 128K, was greeted with boos by the press and a universal yawn from the public. But once again, IBM's Entry Systems Division showed itself willing to change—and anxious to redeem its good name. At the end of July of this year, IBM announced a series of improvements for the PCjr, including a new full-stroke keyboard and memory modules that can take the machine to 512K. Also included in the announcement was the availability of *Lotus 1-2-3* on a plug-in ROM cartridge and an IBM-sanctioned RAM disk that would simulate a second disk drive.

Now, the PCjr seems poised for an invasion of the country's offices for use in stand-alone word processing, data entry, and spreadsheet applications, and a renewed mandate as the home computer for personal productivity applications. It will be aided by an

The IBM PC, AT, newest member of the IBM microcomputer family.

The new IBM PCjr keyboard.

advertising campaign deemed the most intensive in the company's history. According to IBM sources, in the period from August 1 to December 31 of 1984, 98% of the American public will see at least 30 PCjr advertising messages.

IBM took one other, unprecedented step: The company announced that any early purchaser of the PCjr would be offered a new keyboard free. No swap, no upgrade fee—no charge. This is roughly equivalent to General Motors sending a telegram to all 1983 purchasers of the Chevy Citation reading: "We have been convinced by pressures of the marketplace that radial tires are better than bias ply tires. We value your early faith in us, and therefore we will be sending you a new set of four radial tires for your car. You can keep the old tires as spares."

Why did they do that? Well, obviously they expected to reap a public relations benefit from the move, and they did. However, it goes deeper than that. As one high placed IBM employee told me, "When we came into the market everyone said that IBM will legitimize the personal computer market and that Big Blue can be counted on to stand behind its products and its customers. That's what we're doing here."

"Apple?," she said, flicking casually at the sleeve of her blouse, "goodbye."

In this new, competitive market, IBM is still operating very cautiously, with one eye always on the U.S. Justice Department. (Push any IBM executive about marketing strategies and sooner or later the antitrust jitters will surface. "You know, if we really wanted to," an IBM executive once told me, "we could buy Apple Computer out of petty cash lying around in drawers in Armonk. Apple?," she said, flicking casually at the sleeve of her blouse, "goodbye."

That almost certainly won't happen, and I'm not convinced very many IBMers would enjoy that. Much of the thrill of success at Big Blue seems to come from competitively won battles, harking for inspiration all the way back to Thomas Watson Sr. and his wagon load of pianos, organs, and sewing machines.

IBM's new PC AT products obviously have stolen back the limelight from compatible manufacturers. It seems likely that we will see another cycle, with the PC AT becoming the standard for the next round of competition. IBM should sell a lot of PC ATs as well as other machines in the PC family, and then just as the rest of the industry comes close to catching up with them, IBM will move on, leaving the others gasping in its wake. ■

DAVID H. AHL

ANSWERS TO QUIZ

1. B
2. A
3. C
4. C
5. B
6. B
7. A
8. B
9. A
10. D
11. A
12. B
13. B
14. D
15. B
16. D
17. C
18. D
19. C
20. D
21. A
22. C
23. D
24. B
25. C
26. C
27. B
28. D
29. A
30. C
31. D
32. B
33. B
34. D
35. A
36. C
37. B
38. C
39. C
40. C
41. C
42. B
43. C
44. D
45. B
46. D
47. B
48. C
49. D
50. C

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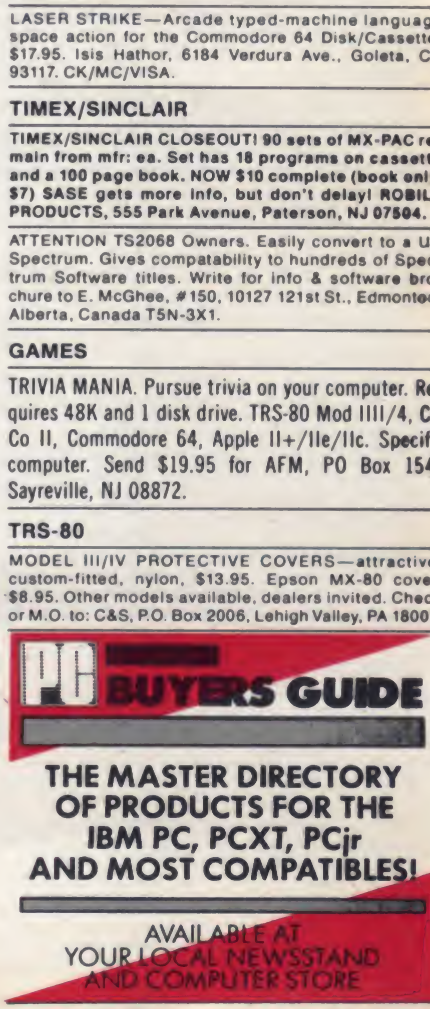

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